Alberta-Pacific FMA Area – FMU L1
Mixedwood Management Timber Supply Analysis

Prepared by:

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1. EXECUTIVE SUMMARY

Alberta-Pacific Forest Industries Inc., (Alberta-Pacific) and Vanderwell Contractors Ltd., have completed the joint development of a sustainable Preferred Forest Management strategy for Forest Management Unit L1. This strategy incorporates mixedwood management, combined mixedwood landbase, a well developed operational harvest sequence and a high degree of operator integration. The proposed Annual Allowable Cut (AAC) for FMU L1 (non-J) and L1J is presented in Table 1.

Table 1. L1 and L1J AAC (m^3/yr @ 15/10 utilization) (proposed).

Annual Allowable Cut (m^3/yr)				
Coniferous			Deciduous	Total
J (FMA)	non-J	total		
102,300	7,700	110,000	180,200	290,200

Considerable effort was expended upon the development of a 15-year operational harvest sequence to tighten the linkages between strategic and operational planning. The operators' have committed to follow the harvest sequence (within ± 20%) as detailed in Section 6. The proposed Annual Allowable Cut distributions for each operator are presented in Table 2.

Table 2. Proposed L1 and L1J AAC distribution (m^3/yr).

	AAC (m^3/yr)		
	Coniferous	Deciduous	Total
Alberta Pacific Forest Industries			
	21,862	178,460	200,322
Vanderwell Contracting Limited			
	58,738	0	58,738
MTU Program			
	29,400	1,740	31,140
Total	**110,000**	**180,200**	**290,200**

*Note: Coniferous stand structure retention is 1% for all dispositions in Table 2

In Table 2, total AAC's have been rounded to the nearest 100; accordingly, the above table illustrates 39 m^3 (Conifer) and 67 m^3 (Deciduous) less than the FMA area AAC table and the L1 FMU AAC summary tables and graphics, in the TSA documentation. Additionally, the above Table 2 differs from Table 3.16 (Page 171) in the FMP due to rounding in the allocations.

Table of Contents

Table Listing

Figure Listing

2. INTRODUCTION

This document describes the development of an implementation plan for a mixedwood management common landbase forest management strategy for Forest Management Unit (FMU) L1. The term L1 is used through out this document and unless specifically noted referrers to both the FMU L1 (non-J) and FMU L1J as described in the main FMP document. This strategy is part of Alberta-Pacific 2004 Forest Management Plan (FMP) submission and must be considered within the FMP framework. A similar strategy was used for FMU L11. The FMU L11 "Preferred Forest Management Strategy" documentation is attached as an addendum to this L1 report. Additionally, landbase determination and Patchworks process flow-sheets were prepared for presentation purposes for the two FMU mixedwood projects. These two flow-sheets are attached to the L1 yield curve appendix and within a CD.

The approach utilized in developing the L1 preferred forest management strategy is unique among the FMUs within Alberta-Pacific's FMP submission. The primary differences are the application of mixedwood forest management silviculture, the use of the Patchworks forest modelling tool, the level of effort undertaken in developing an operational harvest sequence and the level of cooperative planning undertaken between Alberta-Pacific and Vanderwell (the primary quota holder). This approach has produced a higher level of integrated cooperative planning with tighter linkages; strategically–operationally, inter-company and silviculturally–ecologically. This approach and the information generated will provide an adaptive management framework leading to improved understanding of the forest and ultimately better forest management.

The document opens by briefly describing the current and historical strategic forest management situation. The next section summarises the growth and yield information including mixedwood silviculture treatments and their responses. This is followed by a landbase summary which describes the additional steps above and beyond the empirical methodology on an integrated landbase required to implement mixedwood management and operational harvest sequencing. Timber supply assumptions and results leading to the Preferred Forest Management (PFM) strategy follow. The document ends with the rules and targets for implementation and tracking.

2.1. HISTORICAL ANNUAL ALLOWABLE CUTS

The Forest Management Agreement (FMA) between Alberta-Pacific and the Government of Alberta came into effect in 1991. The FMA altered many of the FMU timber areas boundaries and some of the FMU harvesting rights, thus making a clear comparison of Annual Allowable Cuts (AAC) before and after the creation of the Forest Management Agreement problematic. Harvesting rights and allowable cut distribution between operators are dealt with in other sections of the Forest Management Plan submission.

Clarification of the Annual Allowable Cut distribution among timber right holders was required to move from timber harvesting rights based upon divided coniferous and deciduous landbases to a common landbase mixedwood management approach. The historical Annual Allowable Cut distributions at the creation of the FMA are presented in (Table 3).

Table 3. Historical AAC distribution for L1 and L1J (15/10-11 utilization).

Company	Timber Rights		FMU	Notes
	Conifer	Deciduous		
MTU	39.20%		L1, L1J	from C and CD stands
MTU		1.00%	L1J	from all stands
Vanderwell	60.80%		L1, L1J	from C and CD stands
Al-Pac	100% incidental		L1J	offer to sawmills
Al-Pac		99.00%	L1J	from all stands

A three-step process was used to determine allowable cut distribution from the mixedwood management strategy.

First, current coniferous and deciduous timber rights under the traditional forest management strategies as listed in Table 3 were applied to areas both within and outside the FMA. This was addressed by bridging the Alberta-Pacific FMA portion (‘J’) and the area outside the FMA (non-‘J’) into a single timber supply area. Even flow was required only on the bridged timber supply area. Deciduous (D and DU) stands were not sequenced in the non-‘J’ landbase.

Secondly, coniferous and deciduous timber rights apply to either the coniferous or deciduous portion of the operable landbase as described in the notes column of Table 3. Mixedwood management requires a combined landbase with no coniferous or deciduous landbase designation.

The third and final issue to address for Annual Allowable Cut Distribution was the additional volume available for the operators that participate in the mixedwood forest management strategy. The additional Allowable Cut due to mixedwood management was determined according to EFM protocols by subtracting the Patchworks baseline run (Table 4) from that derived with mixedwood management.

Table 4. L1 and L1J empirical AAC and distribution (15/10-11 utilization).

Strata	Total AAC m3	Company AAC m3	Allocation	Company
	Deciduous Volumes			
Deciduous	159,500	157,905	99%	Alberta-Pacific
		1,595	1%	MTU
Incidental Deciduous (20 yr avg)	14,500	14,355	99%	Alberta-Pacific
		145	1%	MTU
Total Deciduous	**174,000**			
	Coniferous Volumes			
Incidental Conifer (20yr avg)	19,000	19,000	100%	Alberta-Pacific
Primary Conifer	75,000	45,600	60.8%	Vanderwell
		29,400	39.2%	MTU
Total Conifer	**94,000**			
Total L1 FMU	**268,000**			

Source: Patchworks Baseline run 70008

The volumes presented in Table 4 have been reduced for spatial considerations, structural retention and cull. The applied deductions were: spatial considerations were 10% for all strata, structural retention was 5% for deciduous and 1% for coniferous, and cull was 4% for deciduous and 2% coniferous. These are proposed numbers from the Patchworks baseline (run 70008).

2.2. MIXEDWOOD MANAGEMENT

This document sets the strategic direction for the implementation of mixedwood forest management in L1. The mixedwood management philosophy is based upon the concept of working within the natural succession pathways of the boreal forest ecosystem and utilizing these natural processes to achieve a desired future state. Mixedwood management will be implemented at the forest level and the stand level. Forest level implementation balances the stand types harvested and the silviculture treatments to be applied to meet the forest level objectives. Stand level implementation is the on-ground application of mixedwood silviculture techniques throughout a stand's life cycle (initiation, mid rotation and final harvest). Forest level targets dictate the amount and timing of each treatment. The forest level targets were derived during the timber supply exercise to meet forest management goals.

L1 Mixedwood Management Forest Level Objectives are:

- maintain a balance of main strata types (AW, AWSW, SWAW, SW) through time (maintain 85% of initial distribution);
- maintain or increase the current harvest volumes and balance of species delivered to the mills; and
- maintain landscape patterns.

2.3. MIXEDWOOD MANAGEMENT IMPLEMENTATION

Alberta-Pacific's mixedwood management program was implemented as a two-phase program. The first phase was divided into two components; the first component involved the development of mixedwood treatment yield response predictions and the second component determined the forest level implications of these mixedwood treatments. The first phase was conducted as a pilot program on FMUs L1 and L4 and was documented in two reports: the yield curves are described in Mixedwood Management Alternatives Pilot Project Yield Curves Round 5, The Forestry Corp., July 27, 2000, and the timber supply analysis in Mixedwood Management Pilot – Timber Supply Analysis for FMU L1 and L4, The Forestry Corp., June 8, 2001. These reports were provided to Alberta Sustainable Resource Development (SRD) for review and comments on the general approach and concept.

The second phase of the mixedwood management program is the implementation phase that applies the principles and lessons from phase 1 into the FMP process and subsequent operating plans for FMU L1. This document describes the FMP portion of the second phase.

The efforts undertaken in the pilot project were not duplicated in this implementation phase. However, the important findings from the pilot project are summarized in the appropriate sections.

3. YIELD CURVES

3.1. OVERVIEW

Mixedwood management yield curves for timber supply were prepared to model the volume impact of mixedwood silvicultural treatments. Mixedwood curves were developed using a combination of stand growth models, plot data, empirical evidence, existing yield curves and expert knowledge. The process is explained in detail in Yield Curves for Mixedwood Management, The Forestry Corp., August 12, 2002 (The Forestry Corp 2002).

Mixedwood yield strata were created to meet silviculture and modelling requirements of mixedwood treatments. Empirical plot-based standing timber yield curves were constructed for each stratum following traditional volume-age techniques. These curves were capped at the level of Alberta-Pacific's empirical FMP-wide curves approved for traditional timber supply. A stand growth model, the Mixedwood Growth Model (MGM) was used to develop initial stand conditions that approximated the empirical standing timber yields. Further analysis with MGM was conducted to determine the yield implementations and response of mixedwood silviculture treatments.

The mixedwood yield curves derived from this process were reviewed and compared to the approved FMP empirical standing timber yield curves. Adjustments were made to total volumes to ensure consistency between strata and treatment responses before these curves were used for timber supply. Cull and stand structure reductions were deducted from the yield curves in the analysis.

Mixedwood treatments were developed for only the white spruce and aspen leading strata. Mixedwood regeneration of jack pine (Pj) and black spruce (Sb) strata is more difficult and were considered too costly to attempt real world mixedwood treatments and therefore were modeled as having the clearcutting options.

3.2. MERCHANTABLE VOLUME PREDICTIONS

Merchantable tree volumes were determined using the utilization standards in Table 5 for the merchantable species listed in Table 6. Note that these utilization standards are referred to as 15/10-11 throughout this document.

Table 5. Utilization standards for merchantable volumes.

Species Group	Minimum Top Diameter (cm)	Stump Height (cm)	Minimum Stump Diameter (cm)	Minimum Merchantable Length (m)
Deciduous	10.0	30.0	15.0	3.66
Coniferous	11.0	30.0	15.0	3.66

Table 6. Merchantable tree species in timber supply yield curves.

Yield Curve Species	Merchantable Species Group
Aspen	Deciduous
Balsam poplar	Deciduous
Birch	Deciduous
Balsam fir	Coniferous
Black spruce	Coniferous
Jack pine	Coniferous
Lodgepole pine	Coniferous
White spruce	Coniferous

3.3. MIXEDWOOD MANAGEMENT STRATIFICATION

The mixedwood management strata descriptions used for yield curve development are described in Table 7. Jack pine and black spruce are included to permit the stratification of the entire landbase.

Table 7. Mixedwood management stratification rules.

Yield Stratum Name	Inventory Stratum Name	Inventory Stratum Description	Inventory Stratum Overstory Definition
Aw	Aw	Pure deciduous with no coniferous understory	% Aw + Pb + Bw >= 80
AwUN	Aw/Sw	Pure deciduous with coniferous understory, lag in coniferous height	% Aw + Pb + Bw >= 80, Sw and Sb stems in understory < 400 stems/ha
AwUA	Aw/Sw	Pure deciduous with coniferous understory, lag in coniferous height	% Aw + Pb + Bw >= 80, Sw and Sb stems in understory >= 400 and < 600 stems/ha
AwUY	Aw/Sw	Pure deciduous with coniferous understory, lag in coniferous height	% Aw + Pb + Bw >= 80, Sw and Sb stems in understory >= 600 stems/ha
AwSw	AwSw	Deciduous leading mixedwood aspen-white spruce	50 <= % Aw + Pb + Bw < 80, and 20 <= % Pl + Pj + Sw + Sb + Fb + Lt < 50, with Sw or Fb leading coniferous group
SwAw	SwAw	Coniferous leading mixedwood white spruce-aspen	50 <= % Pl + Pj + Sw + Sb + Fb + Lt <= 70, and 20 <= % Aw + Pb + Bw < 50, with Sw or Fb leading coniferous group
Sw	Sw	White spruce leading coniferous	% Pl + Pj + Sw + Sb + Fb + Lt >= 80, with Sw or Fb leading
Pj Pure	Pj	Pine leading coniferous	% Pl + Pj + Sw + Sb + Fb + Lt >= 80, with Pl or Pj leading
Pj Mix	PjAw	Coniferous leading mixedwood pine-aspen	50 <= % Pl + Pj + Sw + Sb + Fb + Lt <= 70, and 20 <= % Aw + Pb + Bw < 50, with Pl or Pj leading coniferous group
	AwPj	Deciduous leading mixedwood aspen-pine	50 <= % Aw + Pb + Bw < 80, and 20 <= % Pl + Pj + Sw + Sb + Fb + Lt < 50, with Pl or Pj leading coniferous group
Sb Good	Sb	Black spruce leading coniferous	% Pl + Pj + Sw + Sb + Fb + Lt > 20, with Sb or Lt leading, TPR Good
Sb Fair/Medium	Sb	Black spruce leading coniferous	% Pl + Pj + Sw + Sb + Fb + Lt > 20, with Sb or Lt leading, TPR Fair or Medium
None	NonMerch	All stands not fitting into one of the strata above	No definition

The stratification developed for the mixedwood pilot project was altered to better align with the empirical timber supply and company operations. One of the biggest changes was changing the definition of the pure Aw strata from >80% deciduous to => 80% deciduous. This had a large impact on the area of pure Aw but did not alter the mixedwood yield curves as they were created with MGM and capped at the levels of the empirical yield curves. For more information refer to Mixedwood Management Yield Curve Comparison, The Forestry Corp., June 9, 2003.

Operational considerations, specifically for understory protection and understory avoidance in deciduous stands with an understory required the splitting of some the yield strata so that the timber supply could model operations. The subdivided timber supply strata retained the same volume as the original yield strata.

3.3.1. JACK PINE AND BLACK SPRUCE STRATA

Mixedwood management treatments were not developed for the jack pine and black spruce strata. Instead, the existing Alberta-Pacific Empirical FMP volume predictions were used for those strata. However, the difference in strata definitions between the empirical and mixedwood processes required the construction of area-weighted yield curves for the black spruce and jack pine strata according to the rules in Table 8.

Table 8. Empirical yield class descriptions for area-weighted mixedwood strata.

Mixedwood Stratum	DFMP Yield Class Descriptions					
	Yield Class Number	Yield Class Label	Broad Cover Group	Lead Conifer	Crown Closure	TPR
PJ Mixed	10	PjAw/AwPj	CD/DC	Pj	BCD	FMG
PJ Pure	19	Pj-O	C	Pj	AB	FMG
	20	Pj-C-FM	C	Pj	CD	FM
	21	Pj-C-G	C	Pj	CD	G
SB Fair/Med	16	Sb-O	C	Sb	AB	FMG
	17	Sb-C-FM	C	Sb	CD	FM
SB Good	18	Sb-C-G	C	Sb	CD	G

source: 2003 FMP

3.3.2. CULL AND STAND STRUCTURE REDUCTIONS

Cull and structural reductions are applied directly to the yield curves. The amount of reduction was 3% for Coniferous and 9% for Deciduous. This removed the need to reduce the modelling results after each run.

3.4. MIXEDWOOD MANAGEMENT TREATMENTS

Alberta-Pacific and Vanderwell staff developed appropriate mixedwood management treatments for each of the Aw, Aw/Sw, AwSw and SwAw strata. The white spruce strata, while considered part of the mixedwood management strata, was eligible for only clearcutting treatments and thus no mixedwood treatments were developed for Sw. A description of each treatment as modelled in the yield curve building process is presented for each stratum. The values used were designed for average conditions and to facilitate modelling. The specific values and treatment timing described here are average conditions and deviations from these values will be made in field application. These treatments are not designed to constrain field treatment possibilities and should not be used to approve or limit field applications. Overtime, the average result of the field treatments must however, meet the sum of the yield curve volume predictions to support the allowable cut.

3.4.1. STRATUM AW

One alternative mixedwood treatment was developed for the Aw stratum.

UNDERPLANT SW IN AW

White spruce is underplanted in aspen stands greater than 60 years of age. Twenty years later an understory protection harvest would be used to remove the aspen canopy and release understory spruce. The following points describe the changes made to the Aw 'basic' crop plan in order to produce merchantable volumes for this mixedwood management alternative.

3.4.2. STRATUM AW/SW

One mixedwood management treatment applicable at two different ages was initially developed. However, operational input prescribed three different treatments applicable to pure aspen with an identified understory based upon understory density (stems per hectare). These treatments were: understory protection (strata AwUY) for stands with understorys greater than or equal to 600 trees/ha; understory avoidance (AwUA) for stands with understory density of 400 to 600 trees/ha; and clear cutting (AwUN) for stands with an identified understory less than 400 trees/ha.

UNDERSTORY PROTECTION HARVEST OF AW/SW (AWUY)

In this treatment the aspen canopy was removed at either 60 or 80 years of age releasing the white spruce understory in stands with greater than or equal to 600 trees/ha in the understory. The following points describe the changes made to the Aw 'basic' crop plan in order to produce merchantable volumes for this mixedwood management alternative. Crop plans and yield curves were produced for the application of this treatment at two different ages in order to reflect different responses based on stand age.

UNDERSTORY AVOIDANCE HARVEST OF AW/SW (AWUA)

This was a new treatment added in the final round of analysis to better reflect operational reality of understory protection application. Alberta-Pacific completed a coniferous understory density classification based on colour infrared leaf-off photography. Harvesting operations use this density information to initially determine the split between understory protection and understory avoidance. No yield modelling was undertaken for this stratum, but it only applies to understory stands with 400-599 trees/ha of white spruce understory. The initial yield curve retains the same volume as the understory protection curve but the response to treatment is different. Understory avoidance produces deciduous leading mixedwood (curve 2) compared to understory protection, which produces a coniferous stand (curve 4). Refer to the May 7, 2003 transition matrix in Section 5.3 for more information.

3.4.3. Stratum AwSw

One alternative mixedwood management treatment was developed for the AwSw stratum.

Underplant Sw in AwSw

Underplant white spruce in aspen-white spruce stands greater than 60 years of age. After 20 years, an understory protection harvest removes the aspen canopy and releases the understory spruce. The following points describe the changes made to the AwSw 'basic' crop plan in order to produce merchantable volumes for this mixedwood management alternative.

3.4.4. Stratum SwAw

No mixedwood management treatments were included for the SwAw stratum. Shelterwood and seed tree treatments were considered in the early analysis but removed for the Preferred Forest Management strategy due to the uncertainty of the treatment response at this time, and the small AAC impact. Alberta-Pacific will continue to research these treatments.

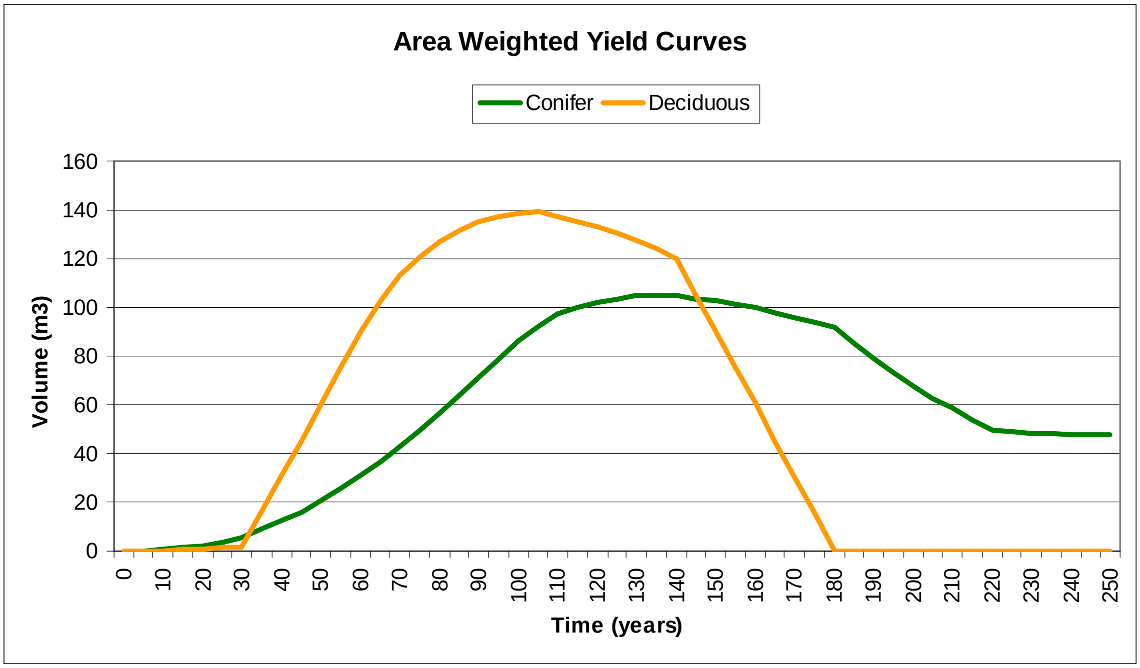
3.4.5. Stratum Sw

Mixedwood management treatments were not developed for this stratum. A seed tree treatment was considered but dropped from the Preferred Forest Management Strategy. An enhanced response to white spruce planting and tending was developed in the pilot project to compare forest level mixedwood management to successful pure species plantation management regime, but was not implemented in the operational model.

3.5. AREA-WEIGHTED YIELD CURVES

To facilitate historical and future comparisons, area-weighted standing volume yield curves were constructed for the timber supply area. Two curves were constructed, one for all coniferous species combined and one for all deciduous species combined (Figure 1). Refer to Appendix I for the complete set of yield curves used in the TSA.

Figure 1. Area-weighted mixedwood management standing volume yield curve (15/10-11 utilization).



The area-weighted curves were not used in any of the analysis, and are included here strictly for a quick assessment of volumes across the FMU.

4. LANDBASE

4.1. OVERVIEW

Alberta-Pacific's FMP netdown landbase was developed by following a consistent process on all management units. The L1 version of this landbase was modified to incorporate mixedwood management strata, operational compartment sequencing and for use in Patchworks. The intent of these changes was to incorporate mixedwood management treatments and greater operational realism in the timber supply, while minimizing landbase netdown changes from the traditional FMP process and to retain as many operability assumptions as possible without comprising mixedwood management or operational realism.

4.2. TRADITIONAL NETDOWN LANDBASE

The starting point for the L1 mixedwood management implementation was the netdown landbase file developed by Al-Pac following the process used for all the Forest Management Units in the FMA. The process and outcome is documented in Alberta-Pacific Landbase Determination Document Version 2.0, April 2002 Timberline Forest Inventory Consultants. This netdown landbase is referred to in this document as the traditional timber supply netdown landbase.

4.3. MIXEDWOOD MANAGEMENT LANDBASE

The implementation of Mixedwood Management required additional information to be added to the traditional timber supply netdown landbase. Most of the additional information required was in the form of attributes. The changes required were:

- ❑ assign mixedwood yield strata;
- ❑ assign Woodstock themes for timber supply;
- ❑ assign compartment boundaries for operational planning; and
- ❑ assign planned harvest block boundaries.

The application of two different timber supply tools (Woodstock and Patchworks) necessitated the creation of two different landbase files. To distinguish between the two landbases each one was named after the timber supply tool. The Patchworks landbase file was derived from the Woodstock landbase shapefile. The intent was to permit the different tools to operate, not to change management assumptions and values between landbases.

Figures 2 through 5 outline the processing steps done on the landbase files to prepare for the mixedwood management analysis. The aml and sql code is provided in Appendix II. A comparison of the netdown landbase before and after the overlays is presented in Table 9.

Figure 2. AML Processing of the Netdown landbase

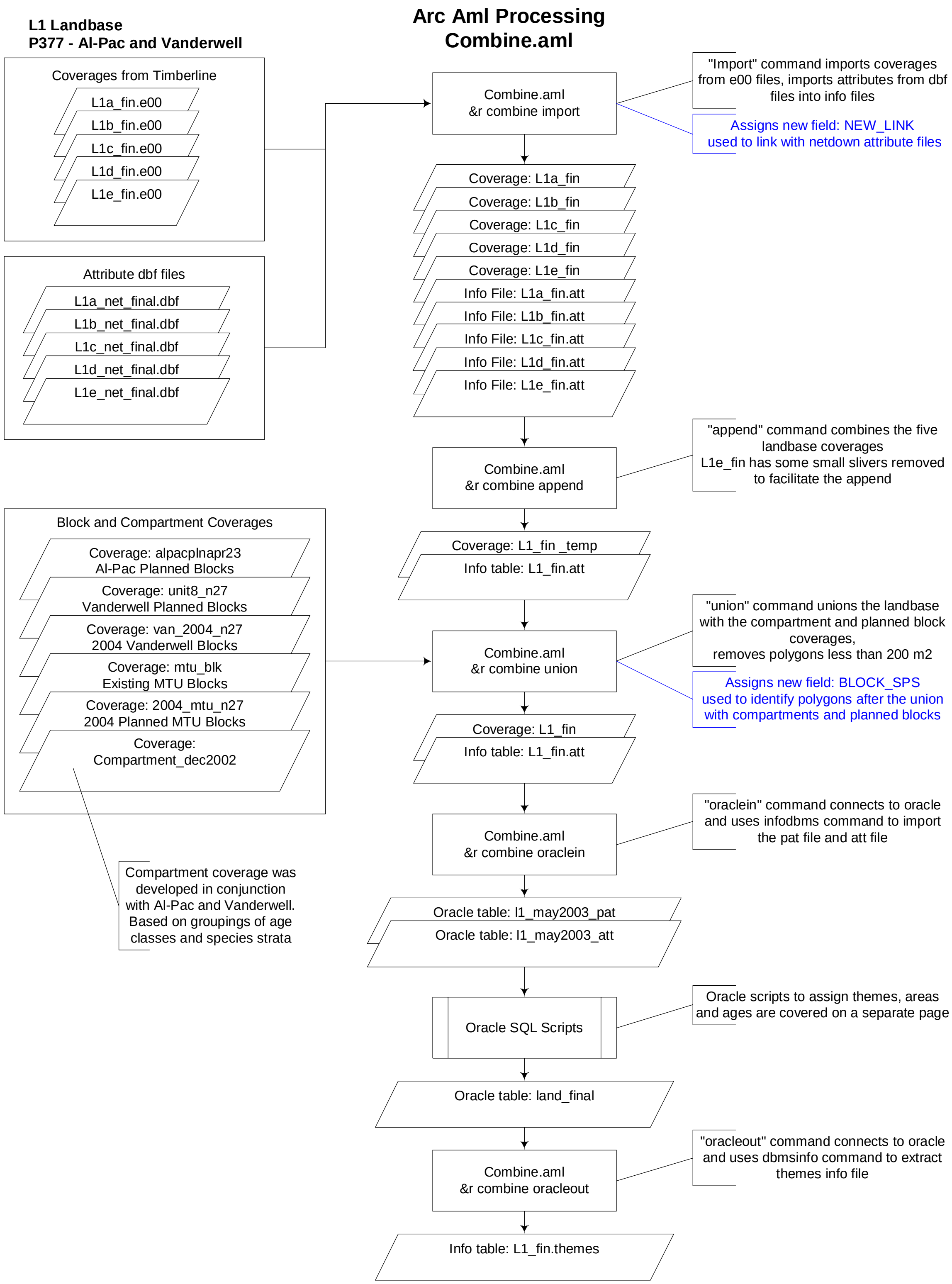


Figure 3. SQL processing of Landbase

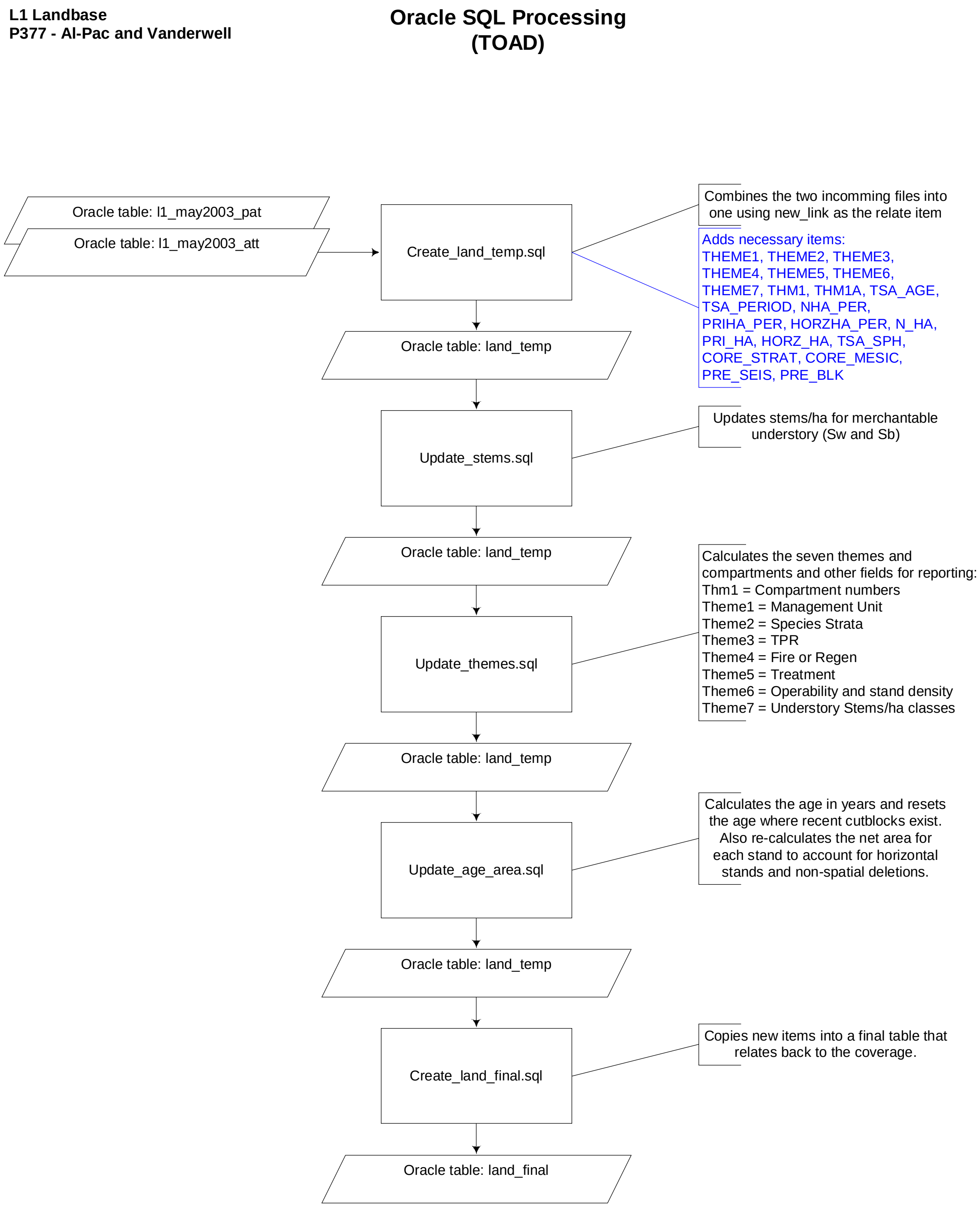


Figure 4. Manual processing to create final shapefile

L1 Landbase
P377 - Al-Pac and Vanderwell

ArcView Processes

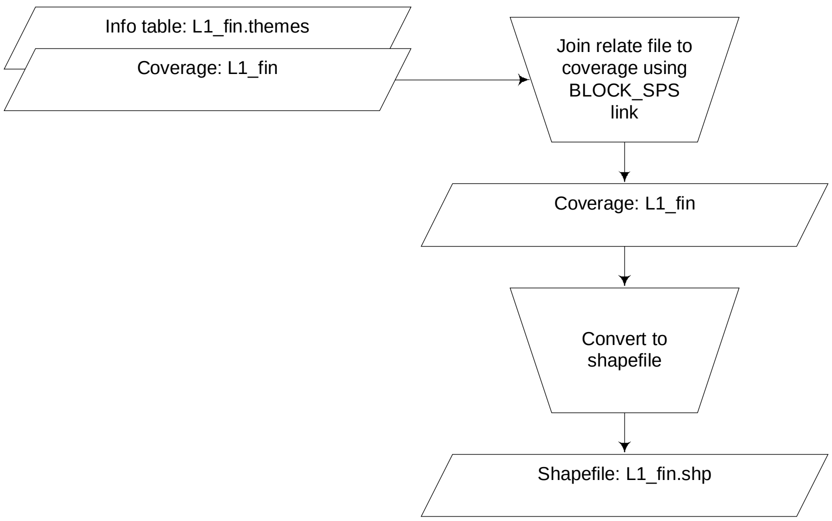


Figure 5. Processing to create Woodstock areas file and Patchworks Model

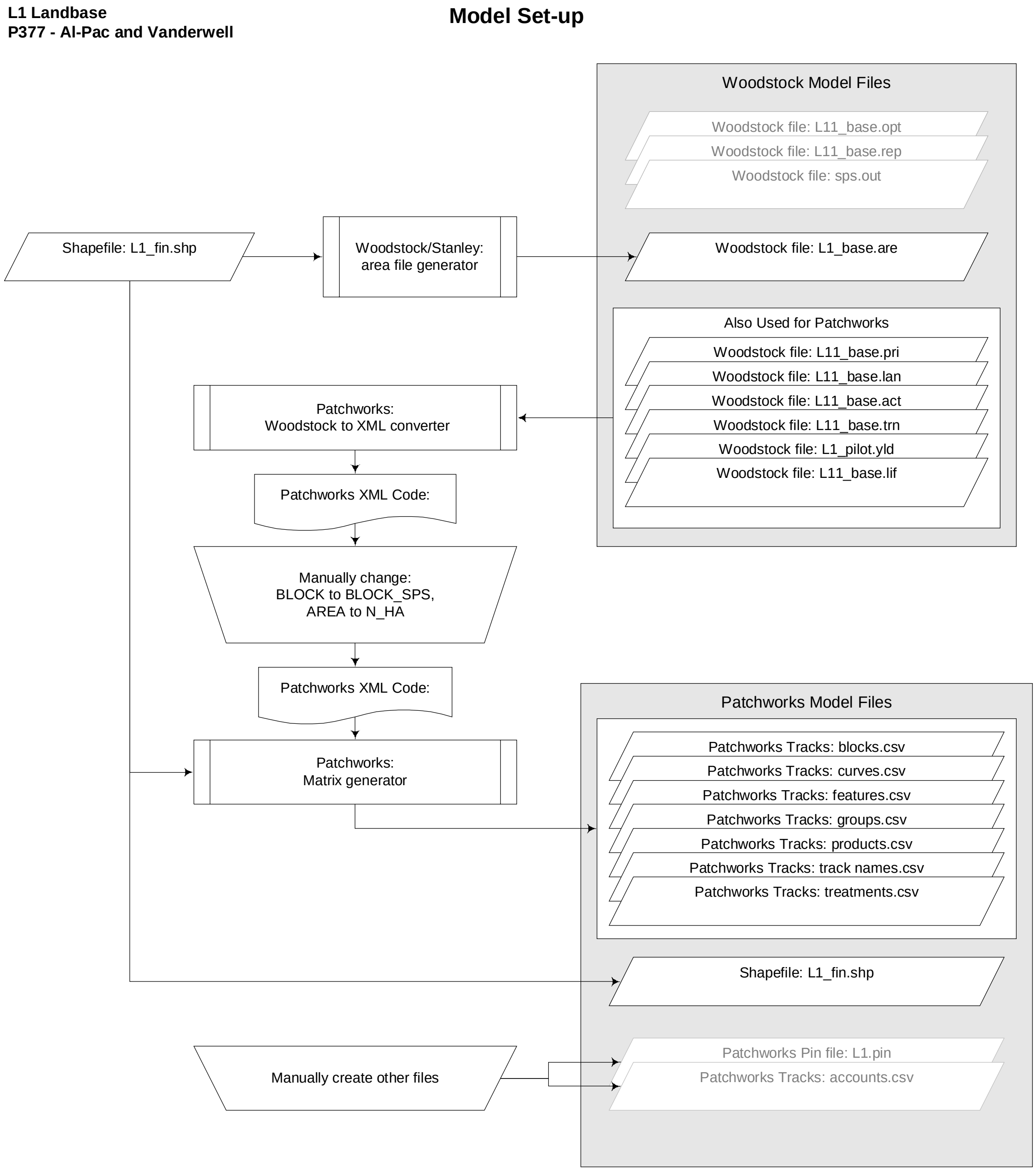


Table 9. Traditional timber supply netdown landbase summary.

Netdown Category (Timberline)	From Timberline FMU area 1 (ha)	Forestry Corp Post Process FMU area 2 (ha)	Difference (ha)	% Total
Prohibits/Precludes Timber Harvesting				
1.a Provincial Park	1,042.78	1,042.78	0.00	0.3%
1.d Protected Notations	66.13	66.13	0.00	0.0%
1.e PSP Buffers	89.61	89.62	-0.01	0.0%
1.h Private Land (non-spatial)	518.40	518.36	0.04	0.2%
Sub-total	***1,716.92***	***1,716.89***	***0.03***	***0.5%***
Recently Disturbed Areas				
2.a Fire	50,876.74	50,876.87	-0.13	15.3%
2.b Oil and Gas	4,193.10	4,193.13	-0.03	1.3%
Sub-total	***55,069.84***	***55,070.00***	***-0.16***	***16.5%***
Inoperable / Isolated Stands				
3.a Slope	0.57	0.57	0.00	0.0%
3.b Isolated Harvestable stands	210.03	210.03	0.00	0.1%
3.c Non-Forested (CC)	586.15	586.15	0.00	0.2%
3.d Non-Forested Natural Disturbance	5,978.47	5,978.47	0.00	1.8%
3.e Non-Forested Vegetated	10,501.69	10,501.76	-0.07	3.1%
3.f Anthropogenic Vegetated	1,632.88	1,632.88	0.00	0.5%
3.g Anthropogenic Non-Vegetated	1,384.47	1,384.52	-0.05	0.4%
3.h Naturally Non-Vegetated	11.47	11.47	0.00	0.0%
3.i Non-Commercial TPR	14,086.96	14,086.95	0.01	4.2%
3.j Non-Commercial Species	47,848.87	47,848.80	0.07	14.3%
3.k Non-Commercial Stand Density	2,568.69	2,568.72	-0.03	0.8%
3.l Non-Commercial Site Index	32,852.75	32,852.69	0.06	9.8%
3.m Horizontal Stand Adjustment (non-spatial)	475.70	475.75	-0.05	0.1%
Sub-total	***118,138.70***	***118,138.76***	***-0.06***	***35.4%***
Water Course Buffers				
4.a Buffers	9,389.27	9,389.13	0.14	2.8%
Sub-total	***9,389.27***	***9,389.13***	***0.14***	***2.8%***
Aquatic Features				
5.a Rivers	320.95	320.94	0.01	0.1%
5.b Lakes	18,419.93	18,419.94	-0.01	5.5%
5.c Flooded Areas	987.76	987.75	0.01	0.3%
Sub-total	***19,728.64***	***19,728.63***	***0.01***	***5.9%***
Timber Harvesting Landbase				
6.a Harvestable Deciduous	65,597.18	65,597.21	-0.03	19.7%
6.b Harvestable DC	6,046.32	6,046.37	-0.05	1.8%
6.c Harvestable CD	6,178.67	6,178.70	-0.03	1.9%
6.d Harvestable Coniferous	44,522.83	44,522.77	0.06	13.3%
6.e Harvestable Deciduous with Coniferous Understory	7,213.47	7,213.48	-0.01	2.2%
Sub-total	***129,558.47***	***129,558.53***	***-0.06***	***38.8%***
Grand Total	**333,601.84**	**333,601.94**	**-0.10**	**100.0%**

Source1: October 2002 traditional netdown landbase using net_label and nha

Source2: May 2003 netdown landbase (post overlays) using net_label and n_ha

4.4. FINAL WOODSTOCK LANDBASE DESCRIPTION

The MWM Woodstock net operable species distribution and density distribution are presented in Table 10 and Table 11. Note that the total net operable area remains identical between tables 9, 10, 11, and 12.

Table 10. MWM Operable Woodstock species distribution (Theme 2).

Theme2 - Species Strata, Timber Harvesting Landbase	Area (ha)	% Operable
1 Pure Aspen (AW)	64,193.6	49.5%
2 Deciduous Leading Mixedwood (AWSW)	4,438.3	3.4%
3 Conifer Leading Mixedwood (SWAW)	4,920.3	3.8%
4 Pure White Spruce (SW)	10,632.5	8.2%
5 Aspen with White Spruce Understory (AWUN)	2,924.1	2.3%
5 Aspen with White Spruce Understory (AWUA)	1,278.2	1.0%
5 Aspen with White Spruce Understory (AWUY)	2,652.7	2.0%
6 A density Aspen (AW-A)	1,721.4	1.3%
7 Pure Jack Pine (PJP)	26,314.0	20.3%
8 Jack Pine Mixedwood (PJMX)	1,974.3	1.5%
9 Good site Black Spruce (SBG)	3,759.0	2.9%
10 Medium-Fair site Black Spruce (SBMF)	4,750.2	3.7%
Total	***129,558.5***	***100.0%***

Source: Woodstock netdown landbase

Table 11. MWM Operable Woodstock density distribution (Theme6).

Theme6 - Stand Density, Timber Harvesting Landbase	Area (ha)	% Operable
A	5,983.1	4.6%
B	17,869.2	13.8%
C	83,326.2	64.3%
D	22,380.0	17.3%
Total	***129,558.5***	***100.0%***

Source: Woodstock netdown landbase

4.5. PATCHWORKS LANDBASE

Patchworks models required a Patchworks formatted landbase. Initially, creation of a Patchworks landbase was more complex than simply formatting the Woodstock landbase. The process involved the aggregation and division (in the case of larger polygons) of harvestable polygons into “blocks” that were similar enough in age and treatment eligibility to be harvested (treated) as a single unit. Note that these “blocks” are not what is typically called a harvest block but are aggregated together within Patchworks to form harvested “patches”. The Stanley model uses a similar process that aggregates smaller polygons into “potential blocks” that are later combined into harvest “blocks”. The intent of the Patchworks preblocking process was to provide the Patchworks model with operationally realistic blocking options for harvest and to reduce the number of small polygons in the dataset, not to alter the landbase description. This preblocking step was not necessary for the final Round, as increasing computer speed and simpler transitions allowed more polygons to exist in the model. One benefit of this was greater similarity between the Patchworks and Woodstock landbase.

4.6. FINAL PATCHWORKS LANDBASE DESCRIPTION

The final Patchworks net operable landbase summary is identical to the Woodstock breakdown by area (Table 12).

Table 12. Final Patchworks net operable landbase description.

Feature.Area.Managed.* - Timber Harvesting Landbase	Area (ha)	% Operable
1 Pure Aspen (AW)	64,193.6	49.5%
2 Deciduous Leading Mixedwood (AWSW)	4,438.3	3.4%
3 Conifer Leading Mixedwood (SWAW)	4,920.3	3.8%
4 Pure White Spruce (SW)	10,632.5	8.2%
5 Aspen with White Spruce Understory (AWUN)	2,924.1	2.3%
5 Aspen with White Spruce Understory (AWUA)	1,278.2	1.0%
5 Aspen with White Spruce Understory (AWUY)	2,652.7	2.0%
6 A density Aspen (AW-A)	1,721.4	1.3%
7 Pure Jack Pine (PJP)	26,314.0	20.3%
8 Jack Pine Mixedwood (PJMX)	1,974.3	1.5%
9 Good site Black Spruce (SBG)	3,759.0	2.9%
10 Medium-Fair site Black Spruce (SBMF)	4,750.2	3.7%
Total	***129,558.5***	***100.0%***

Source: Patchworks netdown landbase

The information in Table 12 was derived from summing up the Feature.Area.Managed.* for each strata, where * = Aw, AwSw, etc from the patchworks model at time zero. This time zero file was exported from the Patchworks block table utility.

4.7. STRATA NOTES

The AWA strata is defined as the A-density aspen. This strata is not merchantable, but when it dies at age 155 it is regenerated to a B-density aspen stand age age 0. 60 years after that, it becomes eligible for harvest.

The SBMF strata is defined as medium or fair site black spruce. The final set of runs did not use stands in this strata except where included in existing harvest plans.

4.8. THEMES DESCRIPTION

Several items were added to the landbase to enable patchworks modeling. The items added and their descriptions are in Table 13.

Table 13. List of items added to the Landbase.

Code	Item Name	Type	Description	Source Fields	Selection Fields	Values
Combine.aml						
	New_link	Integer	Unique key for combined landbase files from Al-Pac	link_key		1,000,000 - 6,000,000
	Block_sps	Integer	Unique key for final coverage/shapefile	L1_fin#		1 - End of file
update_stems.sql						
	tsa_sph	Integer	Total understory stems/ha	usp*_per, ustems_ha	usp*	0+
update_themes.sql						
	thm1	String	Compartment	comp_label	theme1	c*
	Theme1	String	FMA		net_label	L1J, L1, OUTFMA
	Theme2	String	Species Strata		leadcon, con, dec, uleadcon, ucon, udec, st_used, net_state	AW, AWA, AWU, AWSW, SWAW, SW, PJP, PJMX, SB
	Theme3	String	Site quality	tpr	tpr	1, 2, 3, U, X
	Theme4	String	Stand origin type		cc_yr, g_cc_yr, q_cc_yr, year_cut, mtu_year, year_class	FIRE, REGEN
	Theme5	String	Treatment types		net_label, fire_year, fire2002	NONE, OIL, BURNT
	Theme6	String	Operability and Stand density	net_den	ex1, ex2, ex3, theme3, theme1	NONOP, A, B, C, D
	Theme7	String	Understory category		theme2, tsa_sph	N, A, Y, X
	core_strat	String	Strata used for base core analysis		Theme2	Mesic, PJ, SB
	core_mesic	String	Strata used for detailed core analysis		Theme2	AW, MX, SW, PJ, SB
	pre_seis	String	core_strat before deletion of seismic	core_strat		Mesic, PJ, SB
update_age_area.sql						
	pre_blk	Integer	potential year of harvest for pre-blocks		various preblock fields	2002 - 2006
	tsa_age	Integer	age in years based on 2001 starting point		cuur_age, ucurr_age, various cut age fields and fire age fields	1 - 400
	nha_per	Double	percent of net land area	nha, priha, horzha		0-1
	priha_per	Double	percent of non-spatial private land area	nha, priha, horzha		0-1
	horzha_per	Double	percent of horizontal stand area	nha, priha, horzha		0-1
	n_ha	Double	Area field used in analysis	area, nha_per		0+
	pri_ha	Double	non-spatial private land	area, priha_per		0+
	horz_ha	Double	horizontal stand area	area, horzha_per		0+
	thm1a	String	Compartment, with preblock and non-J designations also	thm1	theme1	c*, preblk, nonJin, nonJout

5. L1 TIMBER SUPPLY ANALYSIS

5.1. OVERVIEW

The timber supply analysis for this mixedwood management implementation was built upon the findings from the earlier L1 mixedwood management pilot project. Critical factors supporting harvest levels, trade-offs, treatments effects and implications of mixedwood management strategies were investigated through Woodstock-based analysis.

The objectives of the pilot project and the primary findings were:

1. **Determine the sustainability and AAC impact of the mixedwood management concept** – Mixedwood management achieved 200-year sustainable harvest levels that were equal or greater than traditional forest management strategies;

2. **Reduce the reliance upon traditional stand replacement silviculture while retaining existing coniferous harvest levels** – Coniferous harvest levels were maintained while the amount of traditional silviculture was reduced;

3. **Maintain a proportion of mixedwood stand types through time** – Mixedwood management increased or maintained the proportion of mixedwood stands types through time; and

4. **Quantify the impact of mixedwood treatments** – 10% to 30% total harvest volume increases over the baseline scenarios were achieved. Combined species harvest levels were predicted to increase up to 20% for L1 over existing harvest levels.

This implementation phase did not reconstruct the pilot project analysis. Although new data sets (landbase and yield curves) were constructed, the differences from the data sets employed in the pilot project were small and were assumed to not alter any of the primary findings. The approach taken to determine a recommended harvest level and associated harvest sequence was to update the datasets, retain similar management assumptions and yield responses and use a spatial modelling tool to determine the harvest level while developing a feasible harvest sequence.

A number of timber supply tools were used to determine the recommended Annual Allowable Cut (AAC) levels. Woodstock was used to guide strategic direction and refine the mixedwood management model. Patchworks was used to develop the spatially explicit harvest sequence and the associated recommended AAC.

Where possible, common data sets were used between the tools. After the Woodstock models were developed, the Woodstock model and data files were used in the construction of Patchworks data files and models. The Patchworks model was used to develop the Preferred Forest Management strategy, which included a 15-year operational harvest sequence and an associated recommended Annual Allowable Cut.

5.2. MODELLING TOOLS

5.2.1. WOODSTOCK

Woodstock is a strategic forest estate-modelling tool developed and serviced by Remsoft[11]. It was used for strategic analysis of timber supply and comparisons of alternative mixedwood management strategies. This strategic analysis provided insight into the selection of specific silviculture treatments, their levels and timing. This information was used to determine the combination of silvicultural treatments that best achieved forest management objectives.

A structured progressive approach was used in the development and analysis of Woodstock models. Increasing levels of constraints were applied in successive runs to meet forest management objectives and to answer specific management questions and issues. The end result of the Woodstock stage were a number of forest management scenarios that met non-spatial objectives.

5.2.2. PATCHWORKS

Patchworks is new to forest management planning in Alberta. It is a spatially explicit wood supply modelling tool developed and serviced by Spatial Planning Systems[12]. Patchworks was designed to provide the user with operational-scale decision-making capacity within a strategic analytical environment. Trade-off analysis of alternative operational decisions are quickly determined and visually displayed.

The tool is fully spatial through both time and space. Patchworks decision space can be thought of as a matrix consisting of each polygon and each potential outcome for every time slice in the planning horizon. Since it is fully spatial, the impact on an adjacent polygon 165 years into the future is considered in the first year of the simulation.

Patchworks is a simulation model that attempts to achieve close to an optimal solution for the objectives and constraints defined. In this case, a variety of constraints and objectives were defined in the data sets and through the user interface. The model solver seeks a solution that maximizes the value of the objective function while not violating the constraints. The terms of the objective function were represented by different features (*i.e.* cubic meters of growing stock, hectares present in each strata) and measured in different units. The terms were combined using weighting factors, which rank the importance and contribution of each factor towards the objective. This formulation allows planners to explore the interactions between attributes such as physical wood supply, harvesting economics and other values.

[11] Remsoft Inc. New Brunswick
[12] Spatial Planning Systems. Ontario

As previously stated, Patchworks operates at the polygon level. In Patchworks terminology, polygons are the smallest element, which in this case were subdivided AVI stands. In the early Rounds of analysis, these polygons were combined together to form operable Patchworks "blocks" (which are the smallest spatial element in the model). Patchworks applies treatments to polygons within an entire block. The outcome for each polygon can be different, but the timing of the treatment is the same for the entire block. For this reason blocks were small and generally constructed of similar yield strata and close to the same age. When Patchworks operates, one or more blocks adjacent to each other can be combined to form "patches". It is these "patches" that are comparable to the traditional harvest block. Opening constraints and objectives are applied at the patch level as the model runs. In the initial Patchworks dataset building process, larger polygons were subdivided to allow for more options in creating harvest blocks and patches.

The final Round of analysis did not aggregate polygons into blocks and as such polygons equaled a Patchworks "block". The rest of the process remained the same.

Patchworks models were constructed from Woodstock models. These ensured tight linkages between models in that the assumptions were similar and provided a check on the operation of both models. The differences between the tools can be summarized as:

- Woodstock is completely non-spatial, every unique type is rolled up into forest classes (strata X age class). The model can then apply actions to all or a portion of that unique forest class. Post-action transitions can be one to many relationships defined as percentages. The optimizer selects the optimal combination of treatments throughout the entire planning horizon to solve the objective function. The forest class temporal solution space is similar to Patchworks except Woodstock operates at the forest class level instead of the polygon level.
- Patchworks tracks all original polygon information within each block. Treatments are applied to an entire block. The solver attempts to solve the optimal solution for the objective function over the entire planning horizon. However, unlike Woodstock, spatial relationships (i.e. patch size distribution) can be applied in the objective function.

5.3. ASSUMPTIONS AND INPUTS

The silvicultural treatment and response assumptions (transition matrix) developed in the pilot project were modified to be used in this analysis. The Pilot project treatment matrix (Figure 6) was developed to facilitate investigations of mixedwood management treatment impacts using Woodstock. The application of the transitions matrix with its one-to-many post-treatment responses presented difficulties and greatly increased the Patchworks model size. The Forest Companies decided to develop a simpler transition matrix that would be easier to apply to different management units and greater areas at once. The result was the May 7, 2003 transition matrix (Figure 7).

Across the top of the transition matrix in both versions are the strata grouping by similar transition outcome (e.g. only one of the two Sb strata is shown but the transition outcome is the same). The left hand column lists the treatments by management intensity. The treatments in the pilot project are additive in that the "mixedwood" treatment set are added to the "herbicide" and "status quo" treatment sets when a mixedwood management strategy is permitted.

Figure 6. Initial Transition Matrix (December 6th, 2002).

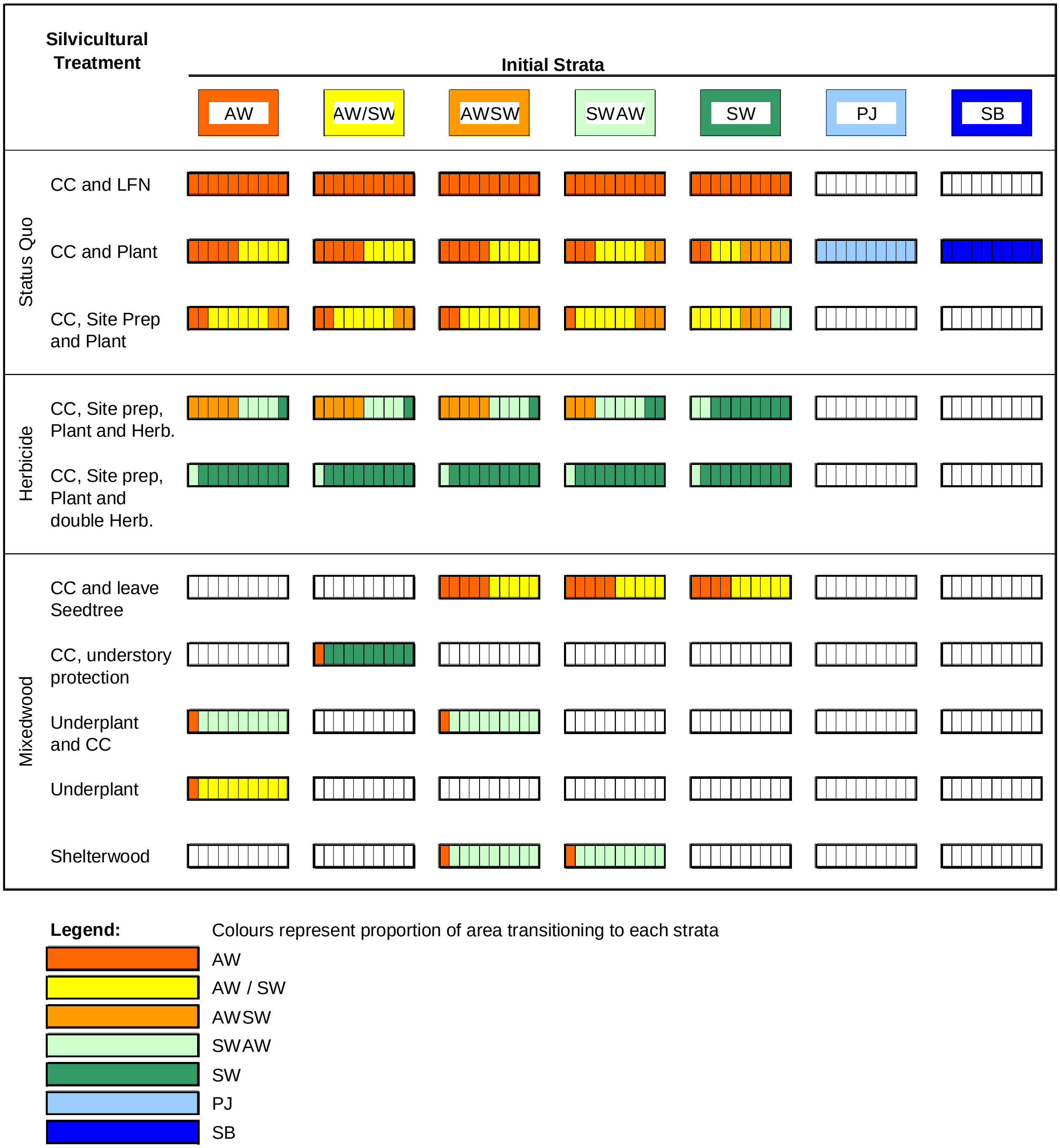
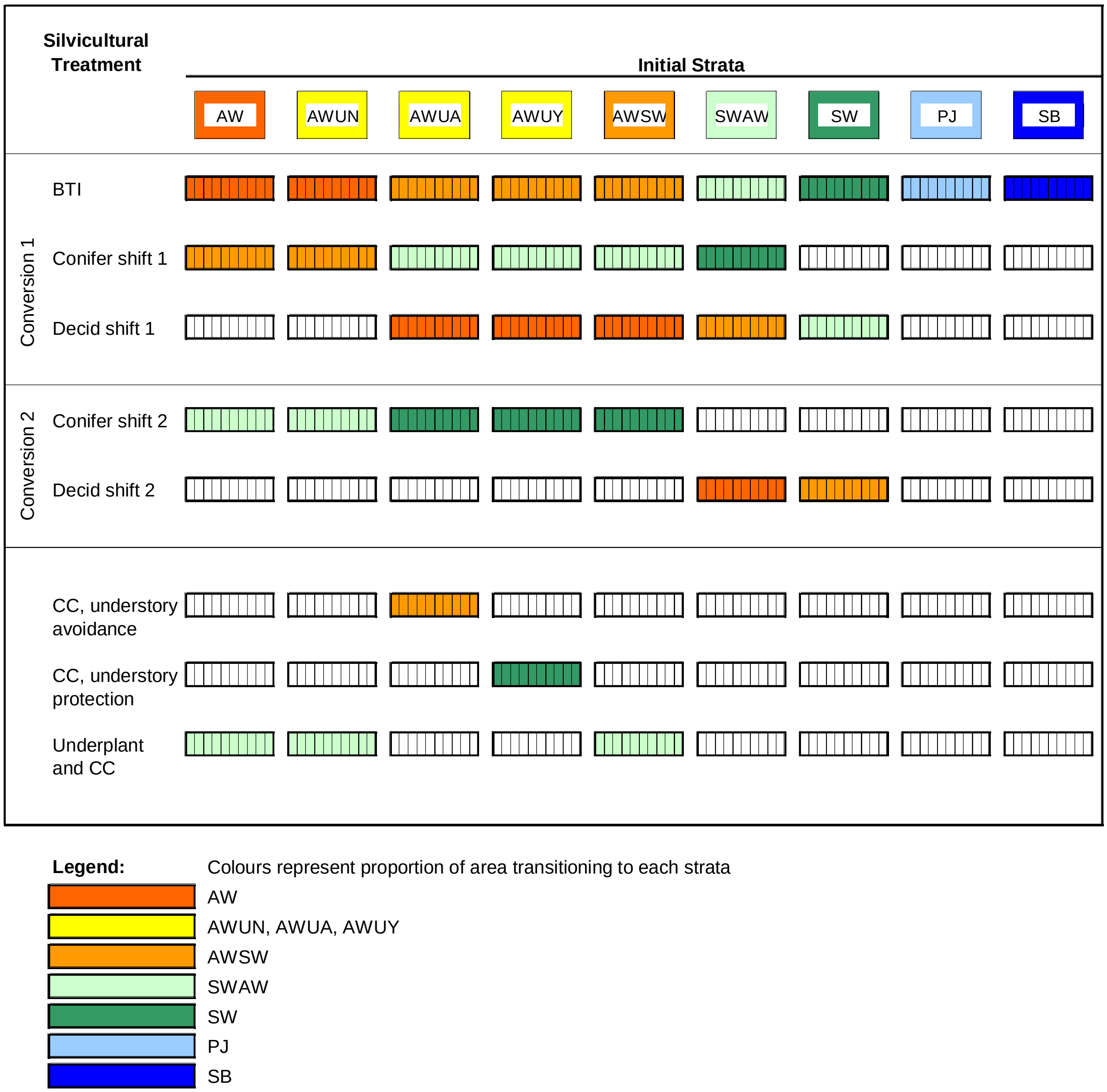


Figure 7. Final transition matrix (May 7, 2003).



Treatments are possible where the cells are coloured at a row and column intersection. The post treatment strata distribution is presented in 10% increments represented by the amount of each colour. For example, under the Aw strata for clearcut, site preparation and plant treatment (CC, Site Prep and Plant) the post treatment transition is 20% Aw, 60% Aw/Sw and 20% AwSw.

The primary difference between the December 6th and May 7th transition matrices was the simplification of post-treatment responses from one-to-many to a one-to-one relationship. Conversion options were included to permit polygons to shift either 1 or 2 strata towards coniferous or deciduous. This change in approach is acceptable because of the overlying forest level constraint that retains 85% of the initial strata distribution throughout the planning horizon. Under either transition matrix, conversions were made up to the 85% limit for a specific stratum.

Part of the transition simplification process was to remove unused mixedwood treatments and include the understory avoidance treatments. This required the subdivision of the old Aw/Sw strata into no understory treatment (AwUN), understory avoidance (AwUA) and understory protection (AwUY). AwUA and AwUY are eligible for understory avoidance or protection between the ages of 60 and 115. They are eligible for the rest of the treatments only after they are 120 years or older. Finally, for the clearcut and regeneration treatments, treatment descriptions summaries are not present, only the required outcome. The actual regeneration method employed remains the silviculturalist's option, only the average outcome is modelled.

The differences between the treatment matrixes can be thought of as the difference between strata level and polygon level approaches. The outcomes in Figure 6 indicate how each strata responds to a specific treatment. The outcomes in Figure 7 describe what each stand can become regardless of treatment. This means that the sum of the stand distribution into the post-treatment strata is driven by the forest land objective. Additionally, Figure 7 describes potential outcomes and does not instruct the silviculturalist on how to generate the desired outcome, only shows the desired outcome.

The transition matrix describes the outcome from silviculture treatments. Natural stand breakup transitions were also included. All stands broke up at specific ages and returned to the same strata at 0 years of age. This rule was selected to mimic the long term impact of fire, not to represent the actual dynamics of each stand type. Breakup ages for each strata were determined according to stand structure and are presented in Table 14.

Table 14. Natural stand breakup ages.

Theme2. Species Strata, Timber Harvesting Landbase	Breakup Age
1 Pure Aspen (Aw)	160
2 Deciduous Leading Mixedwood (AwSw)	200
3 Conifer Leading Mixedwood (SwAw)	200
4 Pure White Spruce (Sw)	200
5 Aspen with White Spruce Understory (Aw/Sw)	200
6 A density Aspen (Aw-A)	160
7 Pure Jack Pine (PjP)	160
8 Jack Pine Mixedwood (PjMX)	160
9 Black Spruce (Sb)	200

The eligibility of a stand for a treatment is based on two factors. One is that the stand be operable according to productivity-based rules in the landbase. This is outlined in the transition matrix in Figure 7. Final transition matrix (May 7, 2003). The second is that the current stand condition pass minimum treatment operability conditions based upon projected stand development patterns. This is represented as stand minimum operability age (Table 15).

Table 15. Minimum treatment operability ages (years).

Strata	Treatment	Minimum Harvest Age (yrs)
Aw	Underplant, wait 20 years then Understory Protection	80
	All Others	60
AwSw	Underplant, wait 20 years then Understory Protection	80
	All Others	60
SwAw	All harvesting	80
Sw	All harvesting	80
AwUA	Understory Avoidance Harvest	60
	All Others	120
AwUY	Understory Protection Harvest	60
	All Others	120
Pj	All harvesting	80
Sb Good	All harvesting	120
Sb Medium/Fair	All harvesting	120

Stands must meet the minimum operability ages to be harvested. For the underplant treatments, the treatment was applied 20 years before harvesting. Understory protection moved the stand to a new condition, which was eligible for clearcut at 80 years for the Sw strata.

5.4. TIMBER SUPPLY RESULTS

The results of all documented runs are presented here in a standard format for each model type. Details for specific runs can be found in Appendix III.

5.4.1. WOODSTOCK

Woodstock modelling was used to investigate strategic non-spatial issues. 24 Woodstock runs were conducted. A summary of the general Woodstock parameters is presented in Table 16. Not all parameters were used in every run. A summary of the Woodstock runs is presented in Table 17.

Table 16. Summary of Woodstock modelling assumptions.

Woodstock Modeling Inputs and Constraints
• Maximize Total Harvest Volume • Even Flow Coniferous and Deciduous Volume • Prevent Growing Stock decline in last 100 years • Smooth out Species Flows (Aw, AwSw, SwAw, Sw only) • Force Sb and Pj harvest to be +/- 10% of period 1 harvest • Strata area restrictions -> each strata 85% of original area (Aw, AwSw, SwAw, Sw only) • No Green-up delay

Table 17. List of Woodstock runs.

Transition set	Name	Objective
December 6th Transitions		
	Run100	No Harvest
	Run101	Bare bones model
	Run102	Smooth Species Volumes
	Run103	Smooth Treatment areas
	Run104	Retain Strata Areas
	Run105	Smooth Treatment areas and Retain Strata Area
	Run106	Smooth Treatment areas and Smooth Species volumes
	Run107	Retain Strata areas and Smooth Species volumes
	Run108	Smooth Treatment areas, Retain Strata areas and Smooth Species volumes
	Run201	Base Run
	Run202	Conventional treatments only
	Run203	Add in Old Growth Constraints
	Run204	Constrain Species Composition Categories
	Run301	Pre-fire Landbase
	Run302	60% burnt area regenerated
	Run303	Pj and Sw GT 18 height regenerated
	Run304	Pj and Sw GT 15 height regenerated
	Run305	Force 33% conifer and 67% deciduous harvest split
	Run306	Maximize Deciduous volume
	Run307	Maximize Coniferous volume
	Run400	Base to compare with 402 and 403
	Run401	test split curves
	Run402	Increase Pj operability age
	Run403	Increase Pj and Sb operability age
	Run404	Increase Sb operability age
	Run405	D(C) changed from mixedwood to pure Aw
Final Set (May 2003)		
	Run601	New transitions and old landbase, but with underplant on
	Run610	Test new yields and landbase, pilot project yields and landbase used
	Run611	Test new yields and landbase, pilot project yields but new landbase used.
	Run612	Test new yields and landbase, new yields and pilot project landbase used.
	Run613	Test new yields and landbase, new yields and landbase used.
	Run614	Test new yields and landbase, pilot project yields but new landbase used.
	L1_base	Model to create Patchworks model

5.4.2. PATCHWORKS

Patchworks runs were conducted to arrive at a spatial operationally feasible Preferred Forest Management (PFM) scenario. Changes in landbases, yield curves and model debugging consumed a large portion of the undocumented runs. However, over 30 runs were dedicated towards the primary purpose of developing an operational harvest sequence. Patchworks modelling assumptions from the Preferred Forest Management strategy are summarized in Table 18 and in detail in Appendix III. Note that the major difference from Woodstock to Patchworks is the addition of spatial constraints such as compartments and pre-blocks.

Table 18. Summary of Patchworks Preferred Forest Management modelling assumptions.

Patchworks Modeling Inputs and Constraints

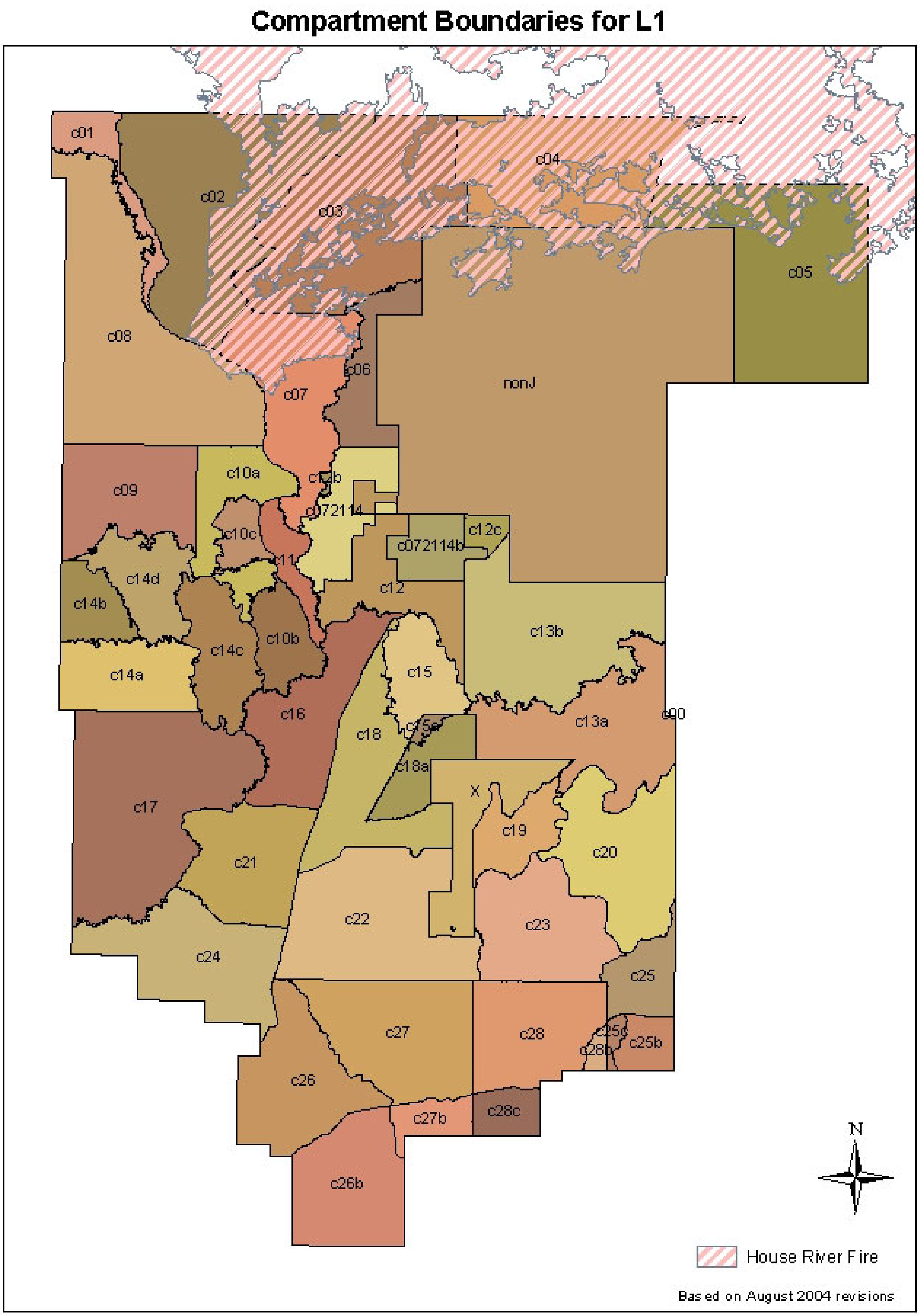
- Control flow of volume with compartments
- Include pre-blocks in harvest sequence
- Maximize Coniferous and Deciduous Harvest Volumes separately
- Even Flow Coniferous and Deciduous Volume
- Prevent Growing Stock decline in last 100 years
- Smooth out Species Flows
  (Aw, AwSw, SwAw, Sw only)
- Smooth Sb and Pj harvest to be nearly even flow
- Strata area restrictions -> each strata 85% of original area
  (Aw, AwSw, SwAw, Sw only)
- Minimize Med-Fair Sb harvest
- Underplant in young aspen stands treatment is not used
- No Green-up delay

In Woodstock modelling, objectives or constraints are rigid and literal. In Patchworks most objectives are targets and a weighting factor determines the impact of deviation from the objective. Even when a high weighting is applied, some deviation from an objective may be noted.

Spatial control over the operable harvest sequence was exercised through the development of operational Patchworks compartments (Figure 8) and the application of treatment availability windows for each compartment.

Compartment control over treatments is very effective in the Patchworks environment. Compartments can be completely turned on or off, or can have block schedules enforced within them. Currently, all actions (including underplanting without immediate harvest) are affected by compartment control. Underplanting and release treatment required a modification as the underplanting action must occur 20 years before the harvest action. This would not be possible with the compartment closed for actions. The underplanting action was manually applied to stands 20 years before the compartment was open based up to the limits determined by runs without compartment controls.

Figure 8. Patchworks operational compartment boundaries.



Developing operationally realistic compartment boundaries and a workable harvest sequence was a large undertaking. Operational and strategic planners from both Vanderwell and Alberta-Pacific designed and modified the compartment boundaries and operational sequence to meet their corporate harvesting objectives while maintaining the harvest level and an appropriate flow of the species harvested.

Operational harvesting objectives applied during compartment sequencing were:

- maintain consistent species flows to all mills;
- minimize impact of compartment sequence upon harvest levels;
- harvest compartments that are decaying faster ahead of more stable compartments. The rate of deciduous volume decay is not the same over the management unit. Stand decay was based upon observation as AVI attributes do not provide this information. Stand age alone does not provide this information. Much of this information was derived from field checking initial harvest sequences and is not reflected in the yield curves at the compartment level;
- group harvesting activities to reduce transport costs;
- balance the amount of merchantable volume extracted with the opportunity cost of delaying harvest in other compartments with significant volume decay; and
- combine coniferous and deciduous harvest operations in the same compartments.

The Patchworks runs undertaken are summarized in Table 19 and presented in greater detail in Appendix III.

Table 19. List of Patchworks runs.

Transition set	Name	Objective
December 6th Transitions		
	Run10000	No Harvest
	Run10001	To establish harvest levels with minimum number of targets
	Run10002	To retain 85% of initial strata
	Run20001	Base Patchworks run
	Run20002	To mimic current operating conditions
	Run20003	Introduce Overmature constraint
	Run20004	Constrain Species Composition Categories
	Run20005	First attempt at Compartments
	Run20006	Second attempt at Compartments
	Run20007	Third attempt at Compartments. Introduce later compartment constraints
	Run20008	Attempt at two pass harvest.
	Run30000	Redo run 20001 with revised model
	Run30001	Use Al-Pac plan to sequence first 15 years
	Run30002	Use Al-Pac plan to sequence first 15 years
	Run30003	Use Al-Pac plan to sequence first 15 years, then force other compartments
	Run30004	Allow block movement within periods
	Run30005	Allow block movement within and between periods
	Run30006	Allow block +/- 2 years
	Run30007	Remove blocks and force compartments (#5 is opened)
	Run30008	Blocks within 5 years and compartments including #5
	Run30009	Allow block +/- 2 years and compartments including #5
	Run30010	New compartments, no planned blocks
	Run30011	Faster cycling through some compartments, others postponed.
	Run30012	Force one '5 year' entry per compartment in first 20 years
	Run30013	Initial compartment sequence in meeting
	Run30014	Intermediate compartment sequence in meeting
	Run30015	Last compartment sequence in meeting
	Run30016	Add small block constraint
	Run40000	No compartments, block ages are fixed (round 5)
	Run40001	Similar to run 30015, new model (round 5)
	Run40002	Split compt 13 into north and south zones
	Run40003	Oct 22 meeting results
	Run40004	Sb removed from harvest
	Run40005	Test new compartments and sequence from Al-Pac
	Run40006	Slight revision to sequence from Al-Pac
	Run40007	Compartment 10 is split
	Run40008	Result of Dec 3, 2002 meeting
	Run40009	Further compartment changes from Dec 3, 2002 meeting
	Run50000	First run with new landbase and curves
	Run50002	First run with SB as its own compartment
	Run50003	To determine harvest level without compartment control
	Run50004	Manually allow young Pj stands to be harvested in Compartment 8
	Run50005	Reduce Pj curves by 10%
	Run50006	60 year compartment sequence

Transition set	Name	Objective
May, 2003		
	Run60004	Model with 60 year compartment sequence, New transitions, etc.
	Run60007	Model with 60 year compartment sequence, Planned blocks are separate compartment.
	Run60008	Planned blocks are separate compartment.
	Run60009	Close to final run to be included in final report
	Run60010	Underplant removed from treatment options. Planned blocks are separate compartment.
	Run60012	Non-J properly split (MTU vs Al-Pac) and smooth decline of Aw and Sw strata.
	Run60013	Only use BTI and SHIFT treatments
	Run60014	Only use BTI treatments
	Run70001	Add in pre-blocks for 2004
	Run70002	Includes 89,263m3 of carryover volume in first five years. Preferred Forest Management scenario
	Run80001	New planned blocks for 6810
	Run90001	New PFM run
	Run90002	C-shift2 and D-shift2 removed
	Run90003	C-shift2 and D-shift2 removed. Extended time allowed to remove 15% of AW strata to 40 years.
	Run91001	C-shift2 and D-shift2 removed. Extended time allowed to remove 15% of AW strata to 40 years. Fix problem with minimum ages.
	Run91004	C-shift2 and D-shift2 removed. Extended time allowed to remove 15% of AW strata to 40 years. Fix problem with minimum ages and underplanting volumes
	Run92001	Model with scheduling changes prescribed by Operations staff. Some other small changes also. September 13, 2004.

5.5. TIMBER SUPPLY INSIGHT

The timber supply insight sections summarises the timber supply issues and discusses their implications for forest management. This insight was derived from both the earlier pilot project and the implementation phase.

The impact of the May 7th transition was an increase of 2.5% total harvest volume (compare Run50006 to Run60009). The difference is likely due to the changes in rates at which conversion can happen but constraints upon the conversion rates and silviculture reduced this impact.

The cooperative harvest sequence development was a first for Vanderwell and Alberta-Pacific's operational planners. This process produced better integration of the two companies' operations and strategic planning and will ease GDP and AOP development and approval.

Mixedwood management scenarios increased the amount of mixedwood stands over time at the expense of pure stand types. This is the opposite trend noted in traditional forest management.

Similar mixedwood treatment options were selected between the Rounds and timber supply runs. The treatment options selection is therefore relatively robust.

There is no short-term (for the next 60 years) operational (spatial) impact on timber supply. Numerous compartment sequencing options were investigated without altering harvest levels. The older forest stands will lose volume faster than they can be cut under an even flow timber-harvesting objective.

It is currently uneconomic to harvest entire compartments in a single entry given the range of age and diameter class distributions present in each compartment and scattered through the management unit. A complete aggregated approach would force harvesting of very young stands while overmature stands decay.

5.6. FEASIBLE MANAGEMENT ALTERNATIVES

A number of economically feasible forest management scenarios were developed incorporating mixedwood management strategies. Alterations in the timing of the operational harvest sequence differentiated these scenarios both spatially and at the rate at which silviculture treatments were applied. A formal list of alternatives from which the preferred would be selected was not formally developed, as the aim was to develop a sequence that meets the management objectives. Therefore a joint Alberta-Pacific and Vanderwell Preferred Forest Management Strategy is presented in section 6.

5.7. TIMBER SUPPLY ISSUES SUMMARY

There were a number of timber supply issues that were addressed in developing the Preferred Forest Management Strategy. Issues and their resolution are summarized in Table 20.

Table 20. Timber supply issues.

Issue	Solution
Pine strata operability	Concerns were raised over the inventory accuracy of the pine strata and the minimum operability conditions. Field investigations demonstrated a large variability between the inventory and field observed heights. This issue was addressed through increased field verification of stand condition and compartment sequence and the coniferous component of the pine curves was reduced by 10%.
Black spruce strata operability	Similar concerns were raised about the black spruce strata. Investigating height age relationships and increasing the minimum operability age from 100 to 120 years addressed this issue.
Black spruce merchantability	Fair/Medium sites are not harvested.
Black spruce harvest volume	Harvesting and regeneration of black spruce strata is a management concern due to smaller piece size, low volumes and high regeneration costs. The impact of excluding all or parts of the black spruce strata was investigated with a sensitivity analysis.
Harvest profile control	To control the harvest profile variations, the fluctuation in the annual harvested area of SB, and PJ was limited to +/- 10%.
Compartment Sequencing	Operational harvest control was largely driven by the application of compartment sequencing. Harvesting was constrained to available compartments. The timing of compartment entry was developed to meet volume flow requirements and concentration of harvesting activities.
Compartment design	Compartments were designed in an adaptive process by Alberta-Pacific and Vanderwell operational staff to meet harvesting objectives while minimizing the impact on AAC.
Older forest targets	Old Forest objectives were defined, tracked and monitored at the FMA level , not the FMU level.
Species conversions	Broad Cover Group (BCG) control based upon initial classification of traditional D, DC, CD and C was achieved in the modeling through a requirement to maintain throughout the planning horizon 85% of the initial strata distribution.
Species Composition Classes (SCC)	The BCG method does not necessarily reflect the stand's species composition throughout its life cycle. This is especially true in mixedwood types. An attempt was made to better reflect the temporal species composition of each strata using Species Composition Classes (SCC). The 4 broad categories used in BCG were calculated for each strata at each 5-year ageclass using volume instead of AVI species composition. The impact of this method was minor and did not fit well with Alberta-Pacific's FMA-wide BCG objectives so this approach was deferred for further study.
Stand breakup	PFM strategy used breakup ages to cycle older aged stands back to younger aged stands of the same type reflecting the impact of fire. Stand breakup ages were strata specific.
Wildlife zones	Wildlife zones for both caribou and moose are present in L1. These zones did not affect scheduling and were not removed from the analysis.
Patchworks transitions following treatment	In the Woodstock models one-to-many relationships following treatments were utilized to account for uncertainty. In spatial optimization models such as Patchworks this is not possible at the sequencing level. To utilize the Woodstock transition process in Patchworks, one-to-many relationships were applied non-spatially within each polygon.
Cutblock size control parameters	Patchworks permits the setting of objectives for opening sizes. This requires the definition of an "opening". The time span between the harvesting event in adjacent blocks will impact the "opening". The initial Patchworks opening was set to greenup delay times for each strata.
MTU allocation	Blocks are scheduled in with the rest of the harvest sequence. Allocation of blocks by company will be undertaken at the AOP level.
L1 and L1J harvest integration	L1 and L1J were not fully bridged for timber supply. The Clyde Lake area which represent the majority of the non-J area was in the operational landbase and treated as two operational compartments, one being the operational strata for coniferous operations and the other the non-operable deciduous strata.

Table of Timber supply issues continued.

Issue	Solution
Grazing leases	Treated as part of the operational landbase (1,388 ha) - therefore fully bridged - available for all treatments. Assigned as part of the "non-J" landbase.
Cut block opening size and shape	No cut block shape specific parameters were addressed. A number of different cut block size opening limitations were investigated. Maximum cut block size limitations were not applied in the PFM strategy. 59 meters were used as the maximum span between polygons within a cut block so that blocks did not span riparian buffers.
Existing harvest plans	Existing preliminary harvest plans for both Vanderwell, Alberta-Pacific and MTU blocks determined by Alberta-Pacific were used in the construction of the harvest sequence.
Single vs two pass harvesting	Moving towards aggregated logging (remove a higher percentage of merchantable fibre from a compartment then leave for extended periods) was a management objective. This was accomplished through the use of compartment control and the amount of harvesting in each.
Black spruce harvest volume fluctuation	Concern was expressed over the fluctuation in black spruce strata (and to a lesser degree in jack pine) harvest volumes. An initial fluctuation of 5% was used and sensitivity analysis was conducted that demonstrated that allowing 10% black spruce fluctuation had little effect in L1, due to the small volumes harvested from black spruce stands. The impact of increasing both pine and black spruce harvest volumes to 10% was about 1%. The final harvest sequence based on Patchworks allocated pine and black spruce stands for harvest as part of the sequencing effort.
Overmature seral stage control	Overmature seral stage value from 0 to 1 was included for each strata to determine the contribution in Patchworks. Older forest targets were set by Alberta-Pacific at the FMA level.
Harvest block condition	The condition of existing harvest blocks was determined by detailed block planning by Alberta-Pacific and Vanderwell Operations staff.
Shelterwood treatment	Removed as a silvicultural treatment in the modeling to simplify the model since it produced little AAC effect.
Cull and stand structure retention deductions	Losses for cull and green tree retention used the FMP values of 3% for coniferous and 9% for deciduous and were applied to the yield curves.
Operational volumes	Volume estimates from Alberta-Pacific's operational volume tables and volumes predicted from TSA yield curves are different. This is especially noticeable in the development of spatial harvest sequences. L1 mixedwood yield curves were used for all volume predictions for L1 but annual variation in the harvest sequence will be required to meet recovered volume objectives. This differences will be resolved when compared to actual in the Stewardship report.
Deciduous - coniferous AAC ratio	The objective was to maximize total harvest volume. Sensitivity analysis demonstrated the impacts of favoring either coniferous or deciduous harvest volumes.
Silviculture treatments outside operable compartments	Patchworks compartments were designed to control harvesting treatments, not silvicultural treatments such as underplanting. The underplanting treatment leading to overstory removal after 20 years, was not allowed for in the Patchworks model construction. This problem was overcome by manually applying underplanting to selected stands before compartments were available for harvesting. Only the first 60 years required this assignment.
Carry-over volume	89,263 m3 of coniferous volume is available for carry-over in the first five years. This has been added to the final sequence at an average rate of 17,800 m3/year.
Distributing mixedwood management benefits	The benefits of mixedwood management was shared by AAC percentage among the operators that plan and commit to mixedwood management treatments. Refer to the sections describing the AAC distribution.
Woodstock - Patchworks comparisons	The impact of formulating a Woodstock model into a Patchworks model was approximately an 7% reduction from non-spatial Woodstock harvest levels.

6. PREFERRED FOREST MANAGEMENT STRATEGY

6.1. OVERVIEW

The Preferred Forest Management (PFM) strategy presented here represents a joint development between Vanderwell and Alberta-Pacific woodlands staff. Both operational and strategic staff were involved in its development.

6.2. PREFERRED FOREST MANAGEMENT DESCRIPTION

Mixedwood management and concentrated harvest blocks are hallmarks of the Preferred Forest Management (Run92001). The main parameters are summarized below and more details can be found in Appendix III.

- retain a minimum of 85% of the current Broad Cover Group distribution;
- maximize total harvest volume object while maintaining an even flow of total coniferous and deciduous harvest volumes;
- congregate harvest activities into operational compartments;
- single combined landbase to manage timber flows, not individual coniferous and deciduous areas;
- regenerated stand patches to reflect the natural distribution of patch sizes and shapes;
- minimized harvest of Medium/Fair site Black Spruce, represents harvest of fringe areas, average is 10 ha/year;
- removed Underplant of immature Aw and AwSw;
- removed C-Shift2 and D-Shift2 treatments;
- removed deciduous harvest from non-J part of FMU; and
- select stands for underplant then clearcut action in the first 15 years.

Table 21. Final Patchworks net operable landbase description.

Feature.Area.Managed.* - Timber Harvesting Landbase	Area(ha)	% Operable
1. Pure Aspen (AW)	63,837	49.3%
2. Deciduous Leading Mixedwood (AWSW)	4,582	3.5%
3. Conifer Leading Mixedwood (SWAW)	4,919	3.8%
4. Pure White Spruce (SW)	10,629	8.2%
5. Aspen with White Spruce Understory (AWUN)	2,817	2.2%
5. Aspen with White Spruce Understory (AWUA)	1,255	1.0%
5. Aspen with White Spruce Understory (AWUY)	2,531	2.0%
6. A Density Aspen (AW-A)	2,172	1.7%
7. Pure Jack Pine (PJP)	26,310	20.3%
8. Jack Pine Mixedwood (PJMX)	1,974	1.5%
9. Good site Black Spruce (SBG)	3,758	2.9%
10. Medium-Fair site Black Spruce (SBMF)	4,749	3.7%
Total	**129,533**	**100.0%**

Source: Patchworks netdown landbase

The strata profile is slightly different as compared to the Woodstock area file. During the later stages of the model, the understorey strata was harmonised with their associated strata. For example, strata previously harvested with an Aw, A density label were updated to AWA. This updated was also applied to the Aspen with White Spruce understory label, where stands were updated to their appropriate strata group (i.e. AWUY/AWUA became AWSW and AWUN became AW). AW-A stands are not initially in the merchantable landbase, upon reaching senescence they return to the merchantable landbase as AW “B-density” stands.

Furthermore, Patchworks performs internal rounding, sliver removal and generalization to make the model efficient. As a result there may be some area differences between the raw landbase file and the area.csv file located in the model.

Outputs from selected reporting parameters are presented on the following pages in graphical form. The 200-year planning horizon is on the x-axis and the parameter in question on the y-axis usually in cubic meters or hectares.

6.2.1. CARRY OVER VOLUME

Carry over volume as a result of harvesting burnt timber is 89,263 m3. This volume is spread out over the first five years at a rate of 17, 500 m3/year. This increase in volume is represented in Figure 9 and Figure 10. (Source: Alberta SRD, 2003)

Harvest Volume

An even flow objective for both total coniferous and total deciduous harvest volume was applied in Patchworks (Figure 9). There were no primary or incidental harvest volumes identified from the common mixedwood landbase. Harvest volume results are presented in (Figure 10). The Pine and Black Spruce harvest targets are also provided. The resultant of the provided target is the most optimal range.

Figure 9 Preferred Forest Management harvest targets (m^3/yr).

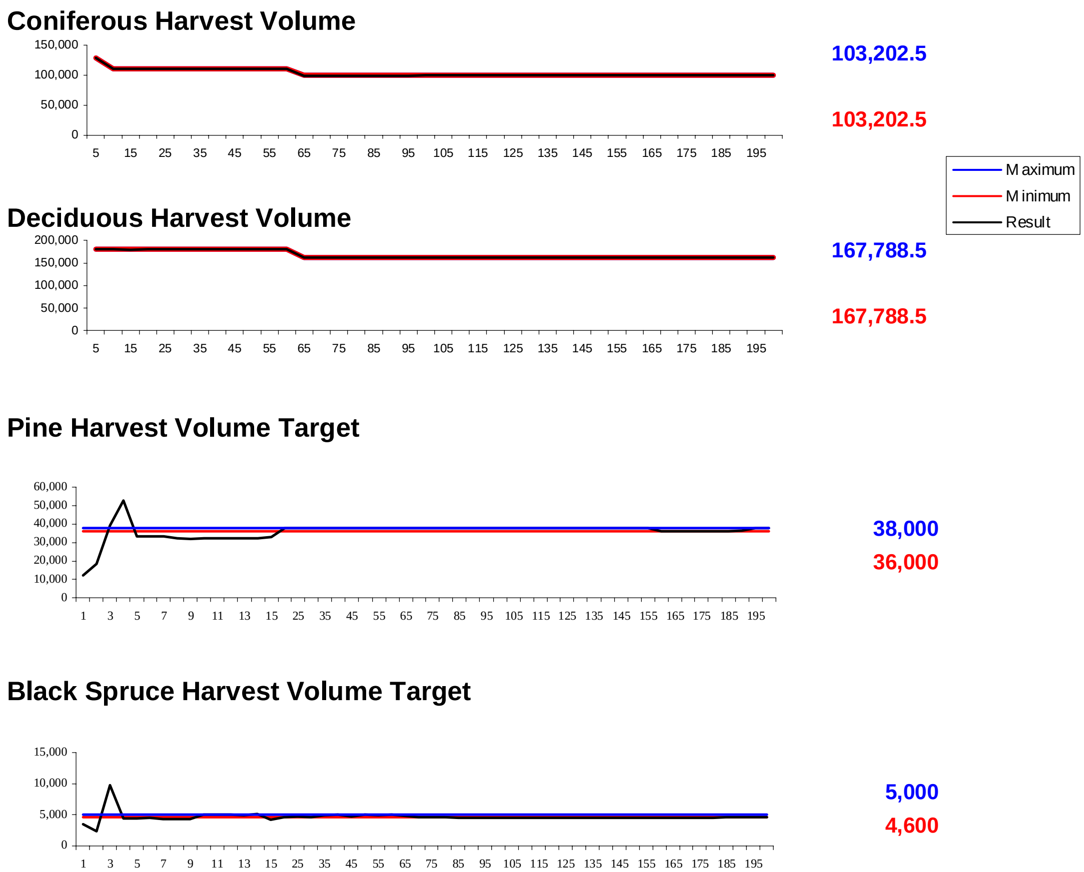
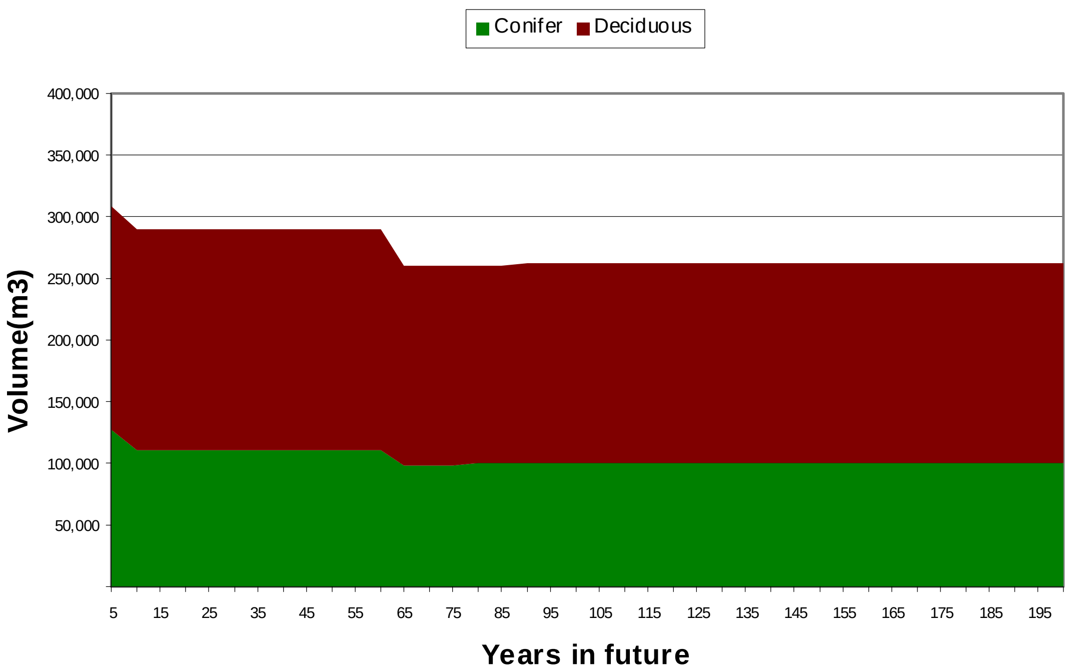


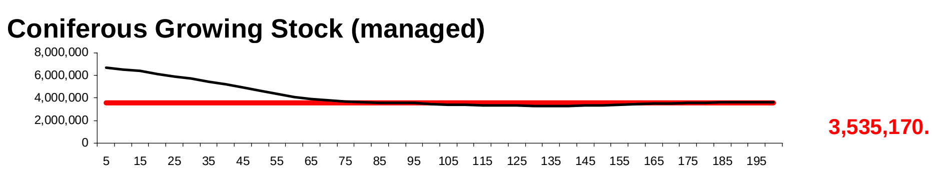
Figure 10. Preferred Forest Management coniferous and deciduous harvest volume (m³/yr).



Growing Stock

Changes in operable coniferous and deciduous growing stock on the landbase over the planning horizon were controlled by the targets in Figure 11 with the results graphed in Figure 12.

Figure 11. Preferred Forest Management managed growing stock targets (m³/yr)



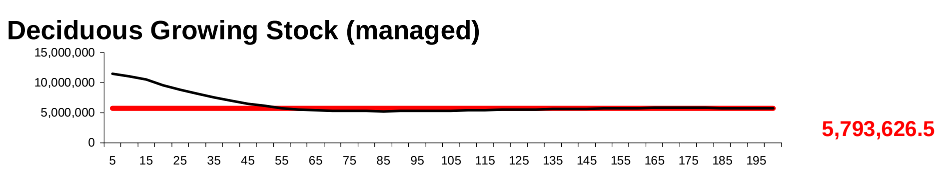
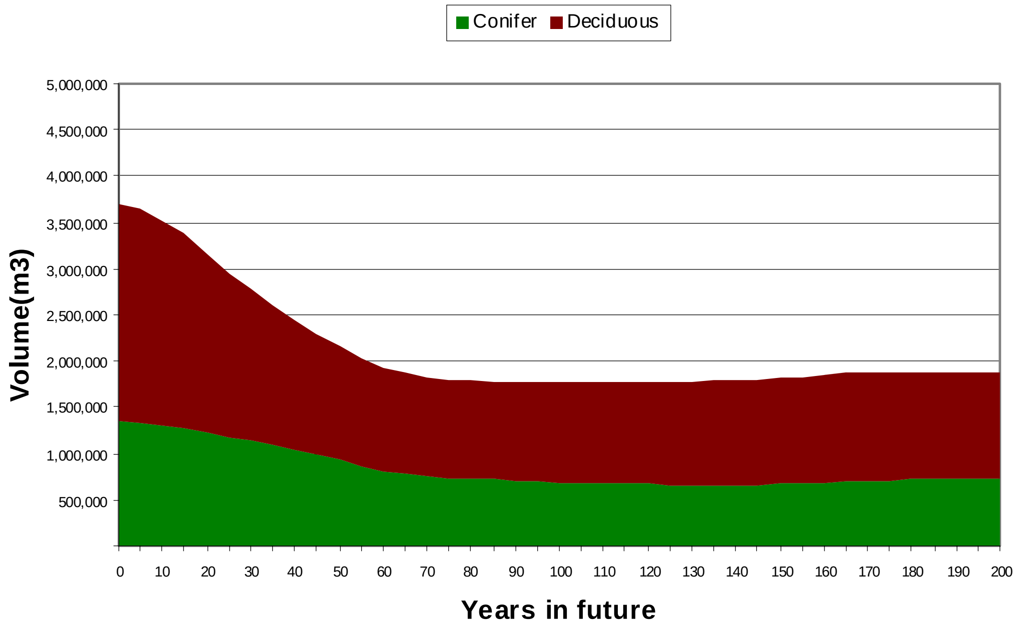


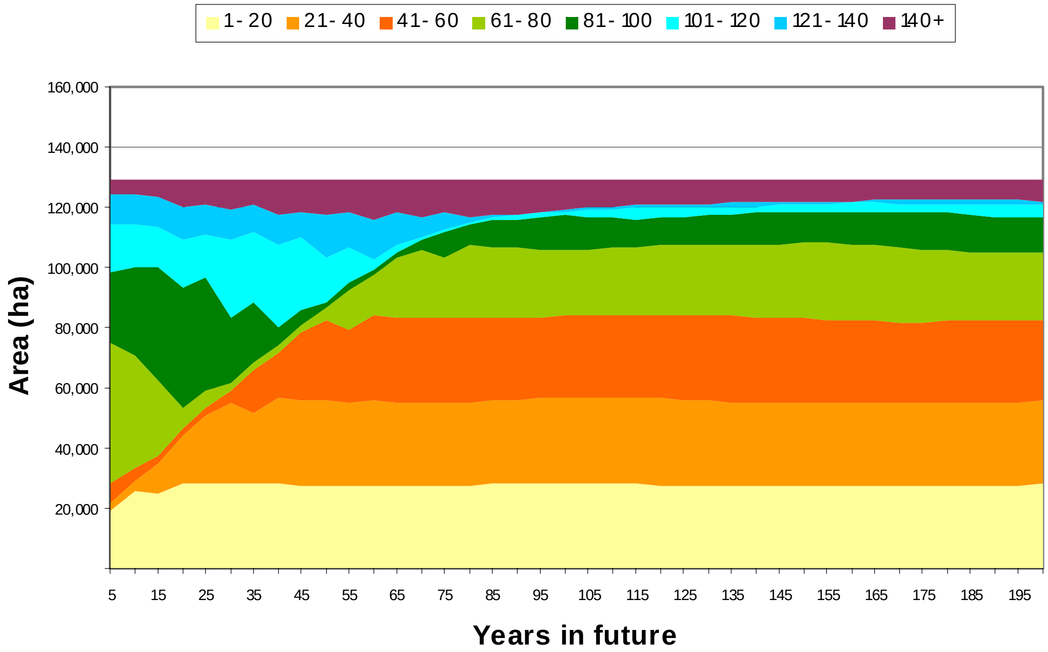
Figure 12. Preferred Forest Management operable growing stock (m^3).



Age Class

Figure 13 shows the 20-year age classes distribution for operable stands over the planning horizon. No Patchworks targets were established for future age class distributions.

Figure 13. Preferred Forest Management age class distribution (ha).



Area Strata

A forest-level objective required 85% of initial areas by broad cover group to be retained throughout the planning horizon. This objective was met by controlling the area of operable strata over the planning horizon by the targets in Figure 14 with the results presented in Figure 15.

Figure 14. Preferred Forest Management targets for operable forest strata landbase area (ha/yr)

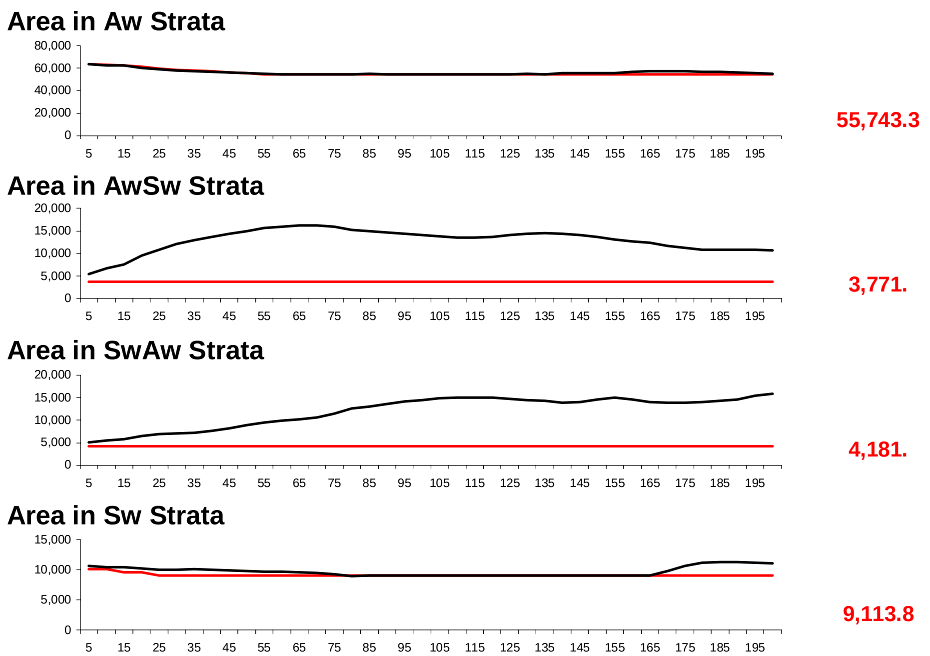
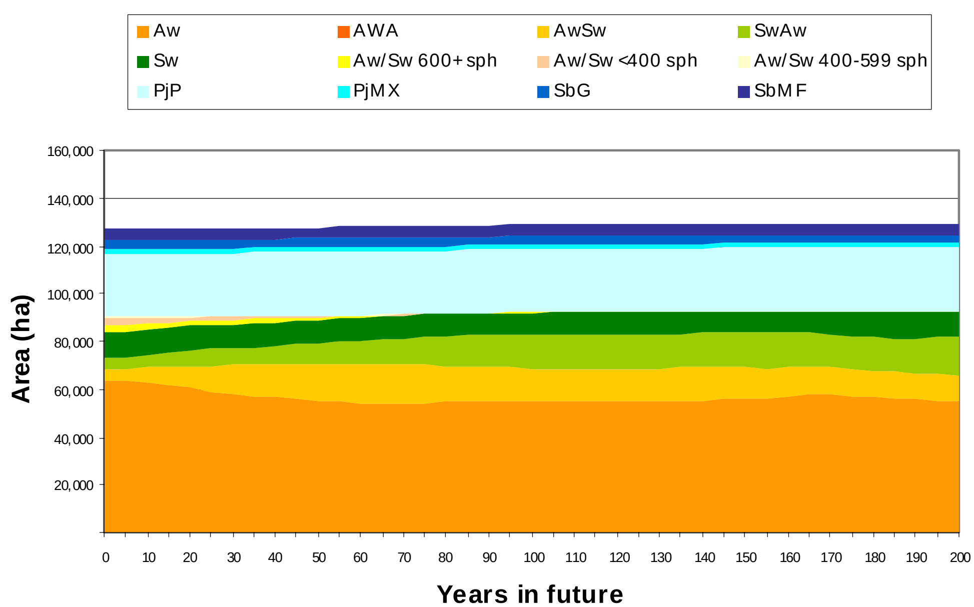


Figure 15. Preferred Forest Management operable forest strata area distribution (ha).



Area Harvested by Strata

Targets in Figure 16 controlled the area harvested from each stratum. Note that the AW area harvested required a large weighting factor (represented by the thickness of the target line with a higher weight representing by a thicker line). The results are plotted in Figure 17.

Figure 16. Preferred Forest Management targets for annual area harvested (ha/yr).

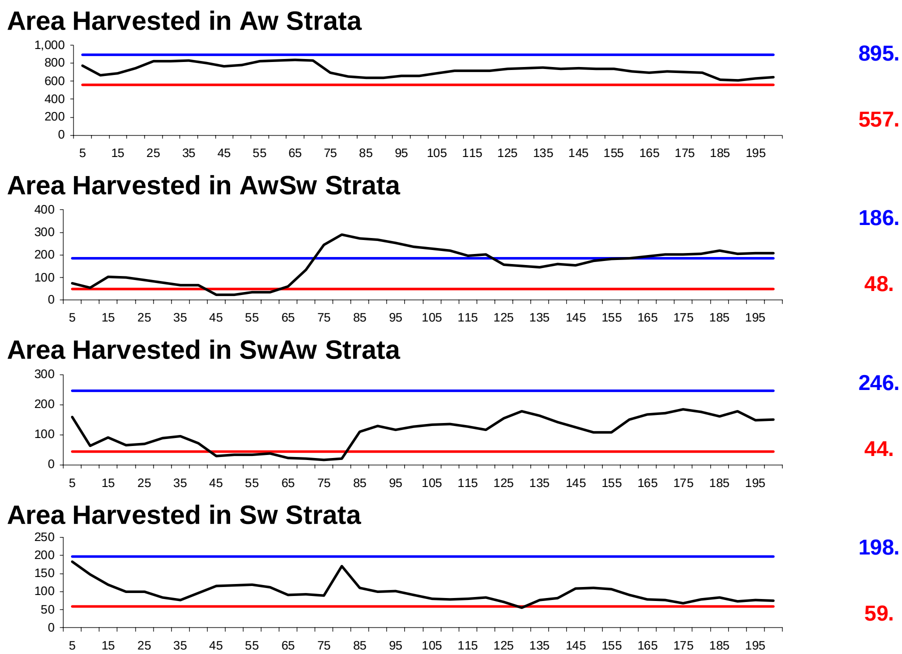
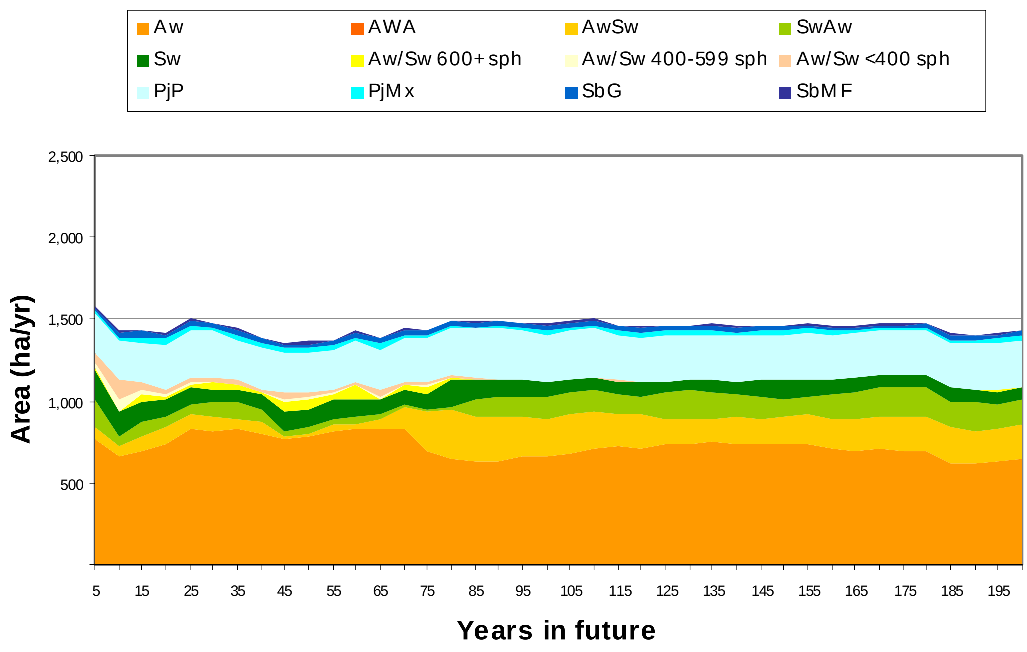


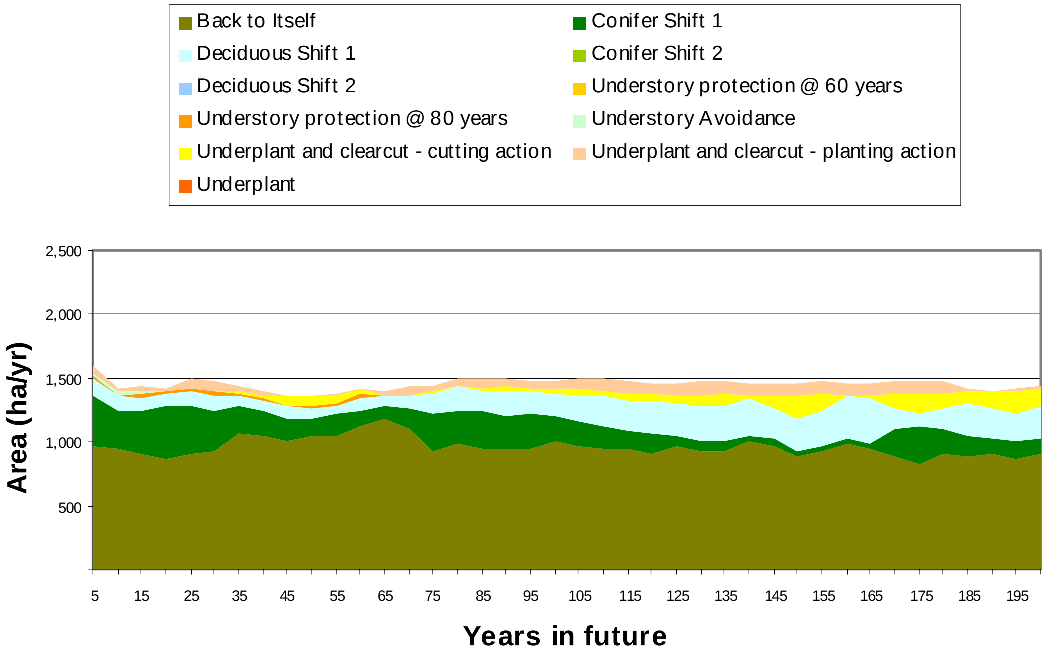
Figure 17. Preferred Forest Management area harvested by strata (ha/yr).



Area Harvested by Treatment

Area harvested by each treatment over the planning horizon is presented in Figure 18. Conversion rates were constrained to reflect operational treatments levels.

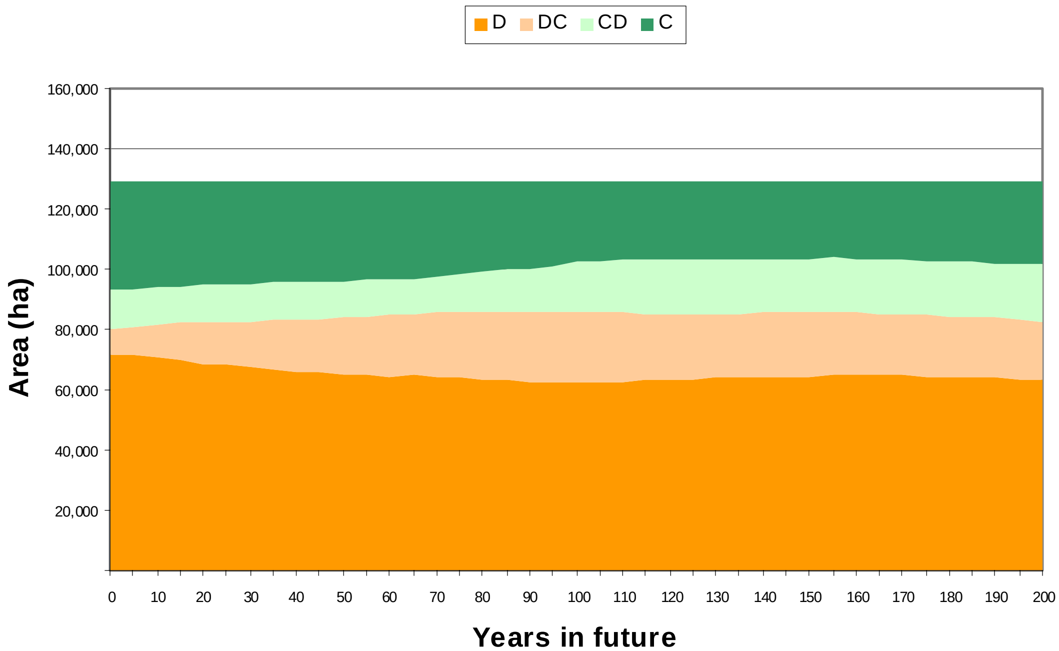
Figure 18. Preferred Forest Management area harvested by treatment (ha/yr).



Species Composition Classess

The distribution of Species Composition Classes (SCC) is provided in Figure 19. These were defined based upon stand species composition as it varied through time for each stratum. No objectives were established for maintaining species composition classes over the planning horizon.

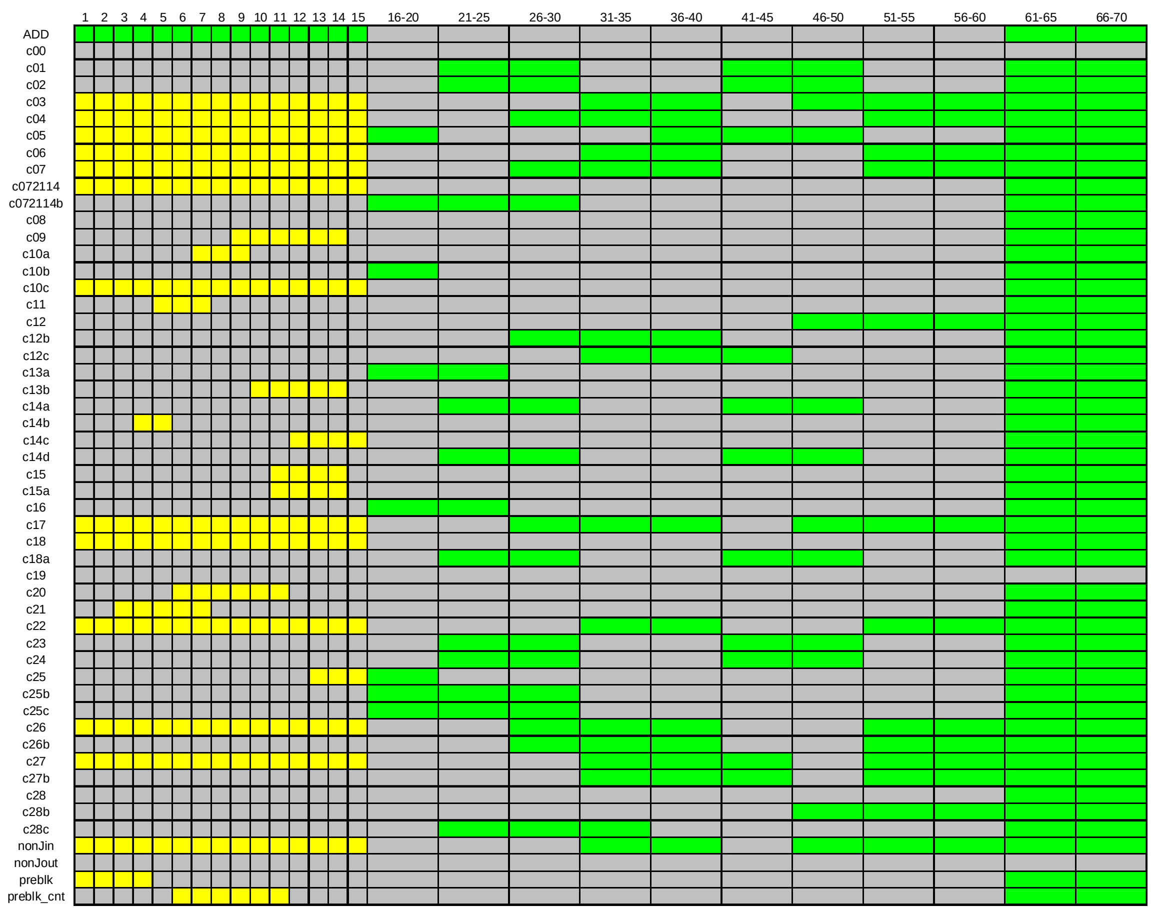
Figure 19. Preferred Forest Management Species composition distribution (ha).



Compartment sequence

The compartment sequence used in the Preferred Forest Management strategy is presented in Figure 20. The time period of the model is across the top (years in future), with the first 15 years represented by annual columns, and the remaining columns represent 5-year periods. The compartments are listed down the side. When a cell is grey, there is no harvesting allowed for that compartment for that period if time. If the cell is green, then harvesting is allowed for that compartment and time period. The yellow cells force the harvest schedule for the coloured compartment. Additionally, yellow cells may represent the underplant action of the "underplant – then-cut" treatment; these compartments were also was tied to the lock down of the harvest sequence when adding additional blocks. The reason for scheduling these compartments into the sequence is because they occur in compartments that are otherwise turned off for harvest action. The compartment accessibility in the last column is repeated for the rest of the planning horizon (not shown). Compartment sequencing covered the first 60 years of the planning horizon as per SRD direction.

Figure 20. Preferred Forest Management compartment sequence.



6.3. FOREST MANAGEMENT TARGETS

Forest management targets are specific indicator statements that were selected to control the actual forest management activities on the ground. They were derived from the output of the timber supply model. To be selected, forest management targets must be quantifiable, easily reportable and appropriate for the preferred forest management strategy. Forest management targets were selected for harvest volumes, the stands harvested and silviculture activities.

6.3.1. ANNUAL ALLOWABLE CUT

Annual Allowable Cut (AAC) targets were derived by coniferous and deciduous species for the total harvest volume.

Table 22. L1 and L1J recommended AAC.

AAC (m^3/yr)		
Coniferous	**Deciduous**	**Total**
110,000	180,200	290,200

The AAC-chargeable species comprising the coniferous volume are: pine, black spruce, white spruce, balsam fir. The deciduous AAC- chargeable species are aspen and balsam poplar.

The AAC is applicable to the timber supply area, which in this case is FMUs L1 and L1J, as defined in the netdown landbase. Thus the AAC above is fully bridged between the FMA and non-FMA component. Note that the non-J component is not scheduled until 31 years into the future.

6.3.2. ALLOWABLE CUT DISTRIBUTION

The AAC allocatation among disposition holders is presented in Figure 21. This information is presented to demonstrate the impact of harvesting within specific strata. The actual rationalization of the AAC distribution and harvest control method is presented in the FMP.

In the following tables, total AAC's have been rounded to the nearest 100; accordingly, the tables illustrate 39 m^3 (Conifer) and 67 m^3 (Deciduous) less than the FMA area AAC table and the L1 FMU AAC summary tables and graphics, in the TSA documentation. Additionally, the following tables differ from Table 3.16 (Page 171) in the FMP due to rounding in the allocations.

Figure 21. Recommended L1 and L1J AAC Allocation

Step 1. Emperical analysis AAC

Obtain AAC volumes from empirical analysis done in Patchworks

	Coniferous				Deciduous	Total
	Primary		Incidental	Total	Total	
	J (FMA)	non-J				
Baseline	67,400	7,600	19,000	94,000	174,000	268,000

Source: Patchworks Run70008

Step 2. Company distribution percentages

Obtain current company distribution percentages from FMA agreement

	Coniferous			Deciduous
	Primary		Incidental	Total
	J (FMA)	non-J		
Al-Pac			100.00%	99.00%
Vanderwell	60.80%	60.80%		
MTU	39.20%	39.20%		1.00%

Source:

Step 3. Company distribution volumes

Calculate company distribution volumes from emperical analysis with values from Step 1 and 2.

	Coniferous						
	Primary J (FMA)		Primary non-J		Incidental		Total
	Percent	Volume	Percent	Volume	Percent	Volume	Volume
Al-Pac	0.00%	0	0.00%	0	100.00%	19,000	19,000
Vanderwell	60.80%	40,979	60.80%	4,621	0.00%	0	45,600
MTU	39.20%	26,421	39.20%	2,979	0.00%	0	29,400
Total	100.00%	67,400	100.00%	7,600	100.00%	19,000	94,000

	Deciduous		Total
	Percent	Volume	Volume
Al-Pac	99.00%	172,260	191,260
Vanderwell	0.00%	0	45,600
MTU	1.00%	1,740	31,140
Total	100.00%	174,000	268,000

Step 4. Mixedwood analysis AAC

Obtain AAC volumes from Mixedwood analysis Preferred Forest Management (PFM) scenario.

	Coniferous			Deciduous	Total
	J (FMA)	non-J	total		
Mixedwood	102,300	7,700	110,000	180,200	290,200

Source: Patchworks Run92001

Step 5. Mixedwood Management increase
Subtract Baseline (Step 1) from Mixedwood Management PFM (Step 4)
to determine increase due to mixedwood management.

	Coniferous			Deciduous	Total
	J (FMA)	non-J	total		
Mixedwood	102,300	7,700	110,000	180,200	290,200
Baseline	86,400	7,600	94,000	174,000	268,000
Increase due to Mixedwood	15,900	100	16,000	6,200	22,200

Step 6. Company volume gains from Mixedwood Increase
Apply negotiated percent split to the increase due to mixedwood from Step 5.

	Coniferous		Coniferous (non-J)		Deciduous	
	Percent	Volume	Percent	Volume	Percent	Volume
Al-Pac	18.00%	2,862	0.00%	0	100.00%	6,200
Vanderwell	82.00%	13,038	100.00%	100	0.00%	0
MTU	0.00%	0	0.00%	0	0.00%	0
Total	100.00%	15,900	100.00%	100	100.00%	6,200

Step 7. Add up company volumes

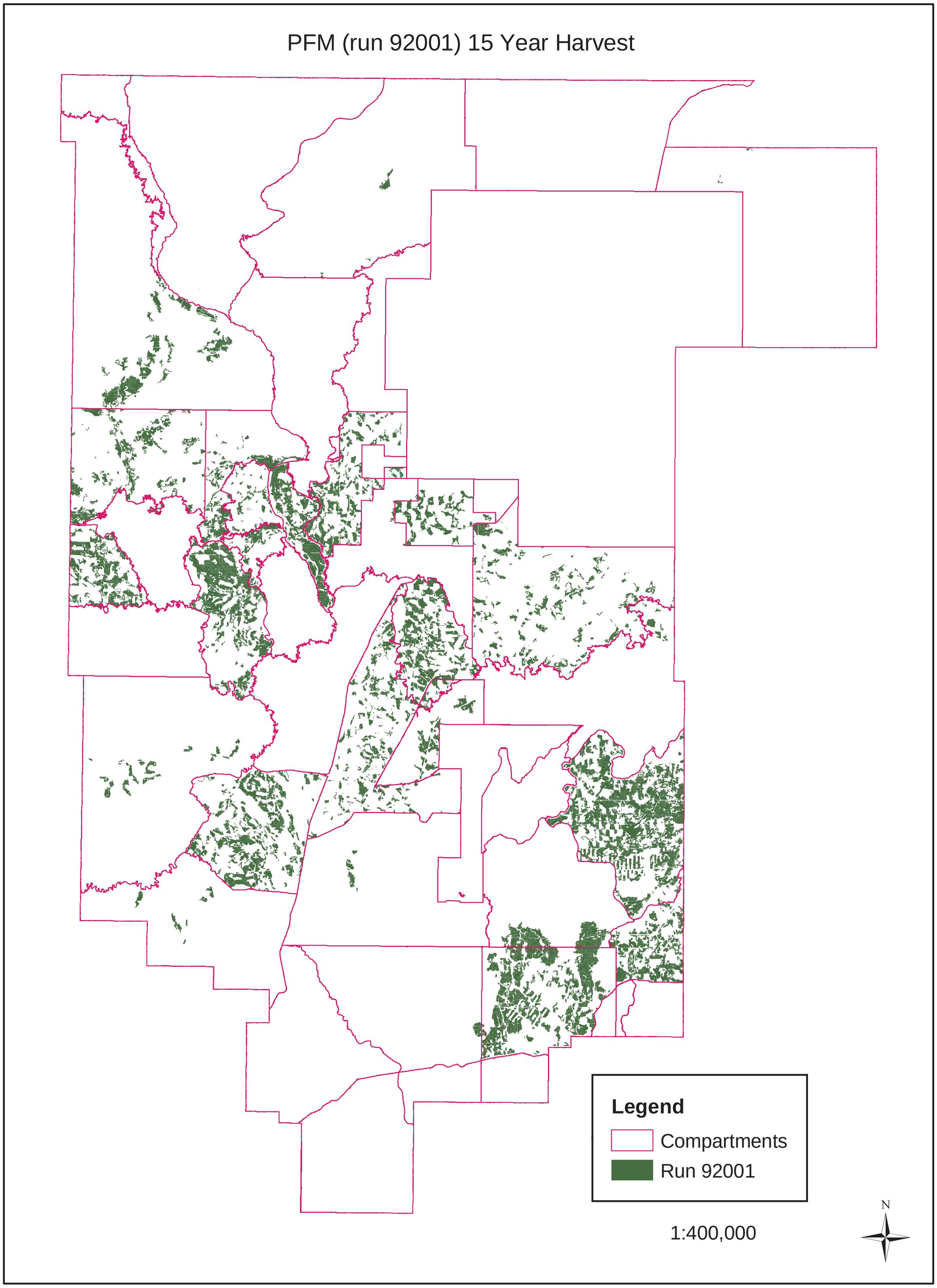
	Coniferous				
	Baseline		Mixedwood Increase		PFM
	J (FMA)	non-J	J (FMA)	non-J	(total)
Al-Pac	19,000	0	2,862	0	21,862
Vanderwell	40,979	4,621	13,038	100	58,738
MTU	26,421	2,979	0	0	29,400
Total	86,400	7,600	15,900	100	110,000

	Deciduous			Total		
	Baseline	Mixedwood Increase	PFM (total)	Baseline	Mixedwood Increase	PFM (total)
Al-Pac	172,260	6,200	178,460	191,260	9,062	200,322
Vanderwell	0	0	0	45,600	13,138	58,738
MTU	1,740	0	1,740	31,140	0	31,140
Total	174,000	6,200	180,200	268,000	22,200	290,200

6.3.3. Harvest Sequence

The harvest sequence was spatially controlled at both the polygon level and at the broader compartment level by timing compartment availability for harvesting activities. As a result, there are both spatial and non-spatial harvest targets derived from the harvest sequence. The first 15 years of the harvest sequence is the list of stands eligible for harvest for the period 2001 until 2016. See Figure 22 for the spatial harvest sequence (SHS) map

Figure 22. Preferred Forest Management SHS Map



Non-spatial harvest targets are present for both volume and area by strata. The harvest targets are presented in Table 23 and Table 24. These tables are calculated from the 15 year sum of harvest areas and volumes divided by number of years (15).

Table 23. 15-year average Harvest Sequence volume targets (m^3/yr).

Initial Strata	Volume Harvested (m^3/yr)			Volume Harvested (m^3/ha)		
	Conifer	Decid	Total	Conifer	Decid	Total
Clearcut						
Aw	12,800	120,300	**133,100**	20	190	**200**
AwUN	1,500	13,700	**15,200**	20	170	**190**
AwUA	1,900	2,100	**4,000**	190	210	**400**
AwUY	0	0	**0**	0	0	**0**
AwSw	7,900	9,400	**17,300**	110	130	**250**
SwAw	16,600	5,500	**22,100**	210	70	**280**
Sw	29,700	3,200	**32,900**	210	20	**240**
PjP	29,800	4,000	**33,800**	120	20	**140**
PjMx	2,000	1,800	**3,800**	100	90	**190**
SbG	3,600	500	**4,100**	120	20	**140**
SbMF	1,000	100	**1,100**	100	10	**110**
Sub-total	106,800	160,600	**267,400**	80	120	**200**
Understory Protection / Avoidance						
AwUY	900	4,900	**5,800**	30	160	**190**
AwUA	700	3,900	**4,600**	40	200	**230**
Sub-total	1,600	8,800	**10,400**	30	180	**210**
All Treatments	**108,400**	**169,400**	**277,800**	**80**	**120**	**200**

Table 24. 15-year average Harvest Sequence area targets (ha/yr).

Initial Strata	Final Strata (ha/yr)								
	Aw	**AwSw**	**SwAw**	**Sw**	**PjP**	**PjMx**	**SbG**	**SbMF**	**Total**
Clearcut									
Aw	440	210	-	-	-	-	-	-	**650**
AwUN	50	30	-	-	-	-	-	-	**80**
AwUA	0	0	10	-	-	-	-	-	**10**
AwUY	-	-	-	-	-	-	-	-	**0**
AwSw	20	10	40	-	-	-	-	-	**70**
SwAw	-	10	40	30	-	-	-	-	**80**
Sw	-	-	70	70	-	-	-	-	**140**
PjP	-	-	-	-	240	-	-	-	**240**
PjMx	-	-	-	-	-	20	-	-	**20**
SbG	-	-	-	-	-	-	30	-	**30**
SbMF	-	-	-	-	-	-	-	10	**10**
Sub-total	510	260	160	100	240	20	30	10	**1,330**
Understory Protection / Avoidance									
AwUA	-	30	-	-	-	-	-	-	**30**
AwUY	-	-	-	20	-	-	-	-	**20**
Sub-total	-	30	-	20	-	-	-	-	**50**
Underplanting									
Aw	20	-	-	-	-	-	-	-	**20**
AwSw	-	0	-	-	-	-	-	-	**0**
Sub-total	20	0	-	-	-	-	-	-	**20**
All Treatments	**530**	**290**	**160**	**120**	**240**	**20**	**30**	**10**	**1,400**

6.3.4. SILVICULTURE TARGETS

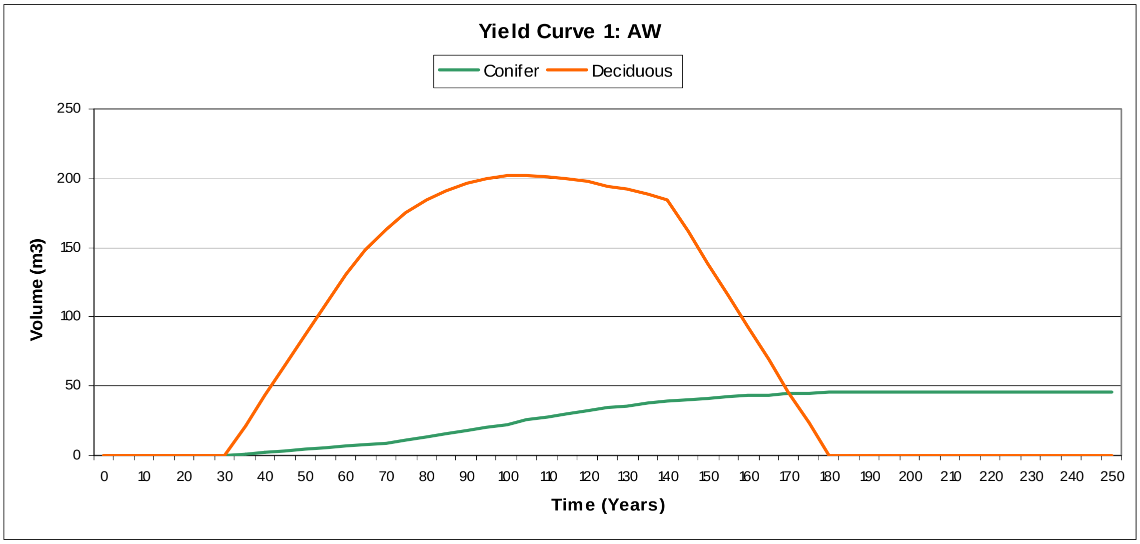
Silviculture targets are also included as part of the management plan. Silviculture targets are the areas (ha) regenerated to each strata and the area by silvicultural systems (i.e. clearcut or understory protection). Targets are provided for the average of the first fifteen years and expressed as an average annual value, and can also be referenced in Table 24. For regenerated areas, the FMP targets are the outcome of the regeneration treatments (e.g. the resulting regenerated strata distribution). The actual regeneration treatments applied to regenerate stands are at the discretion of the silviculture forester and are not specified in this document.

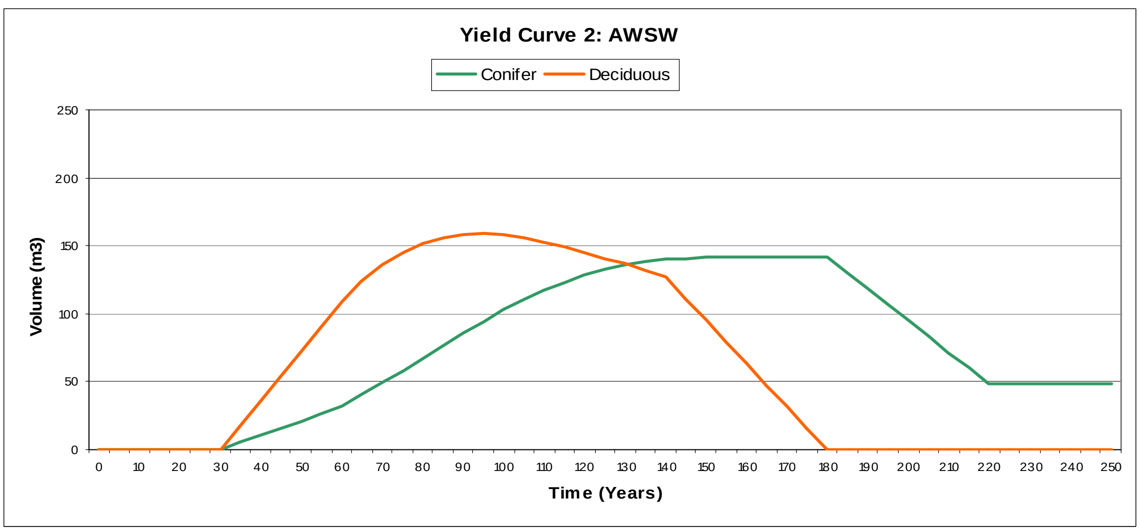
6.4. FOREST MANAGEMENT PLAN IMPLEMENTATION

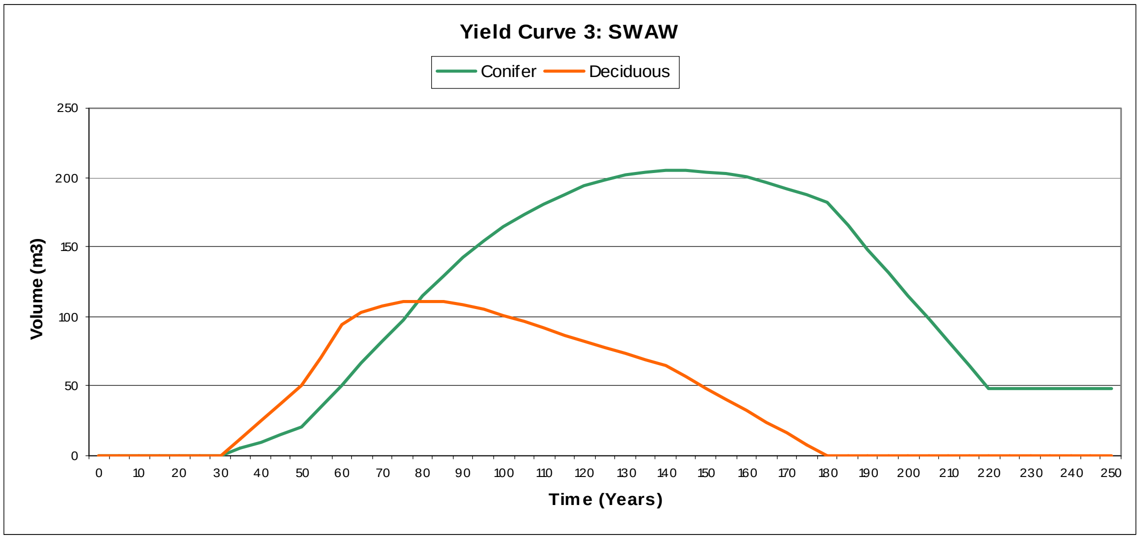
The timber supply and related harvesting and regeneration activities are scheduled to take effect after Alberta SRD approval.

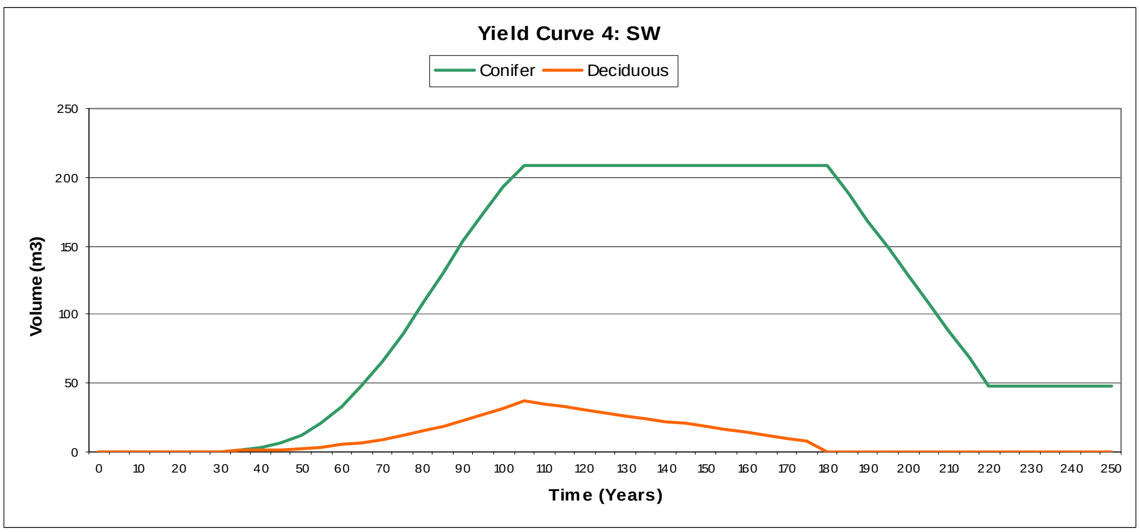
Not all mixedwood or silviculture treatments were modelled in the timber supply. It is not the intent that non-modelled management treatments be excluded from operations. However, these other potential treatments will be AAC neutral. It should also be noted that averages were modelled, but that operational application will have greater variation and apply to a wider range of stand types.

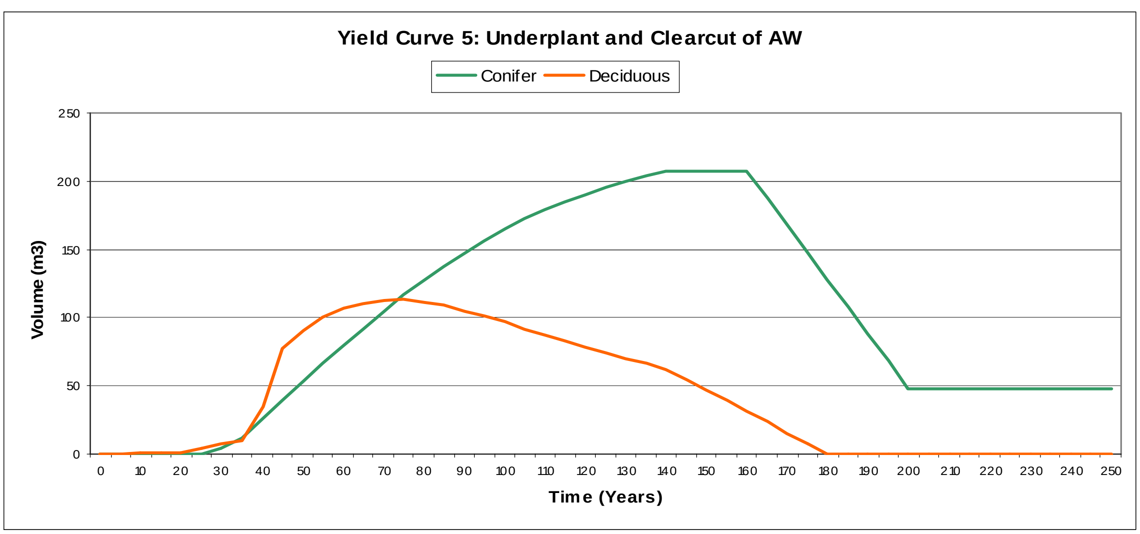
7. APPENDIX I: YIELD CURVES

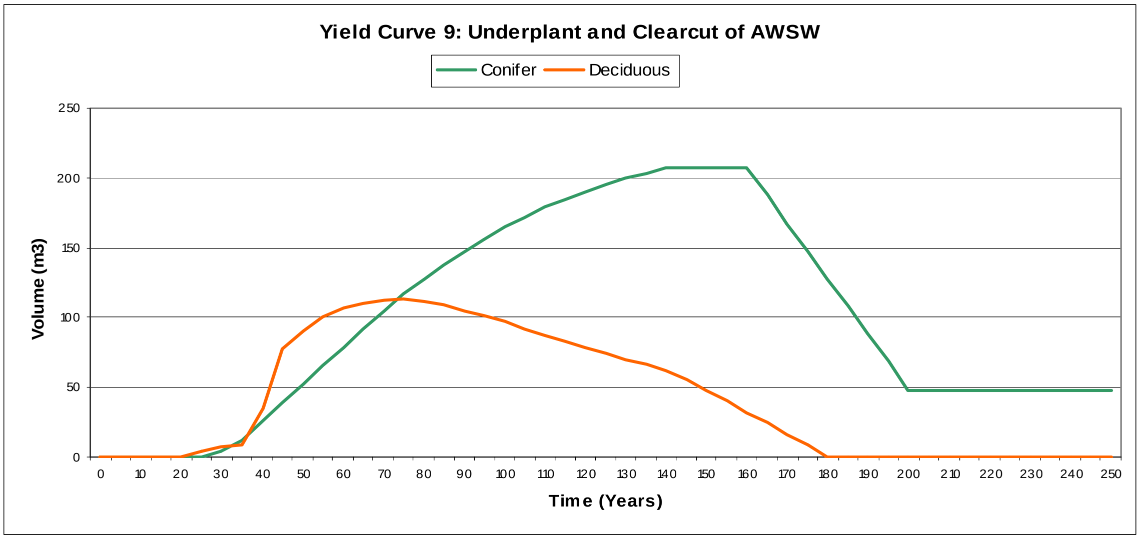


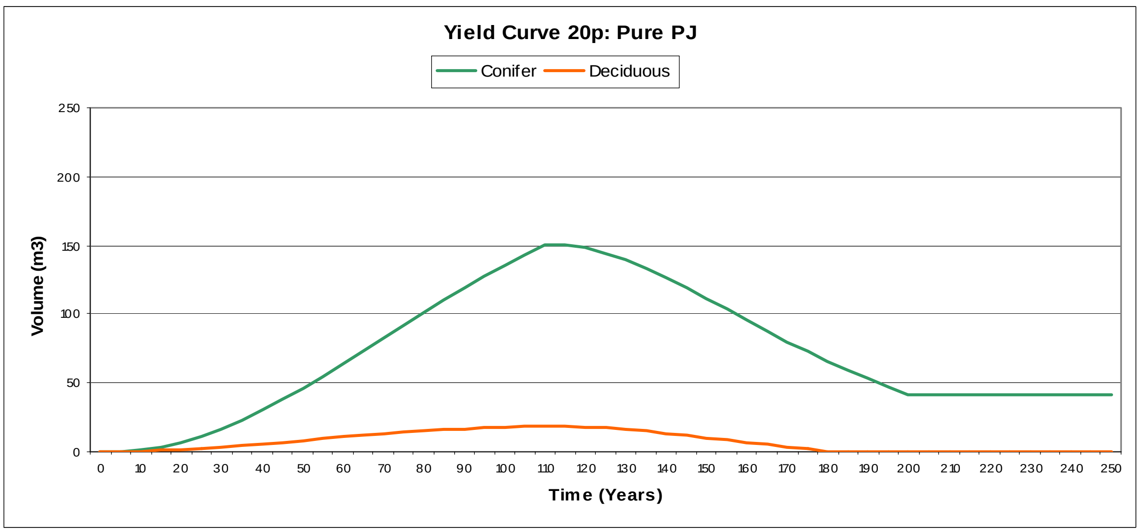


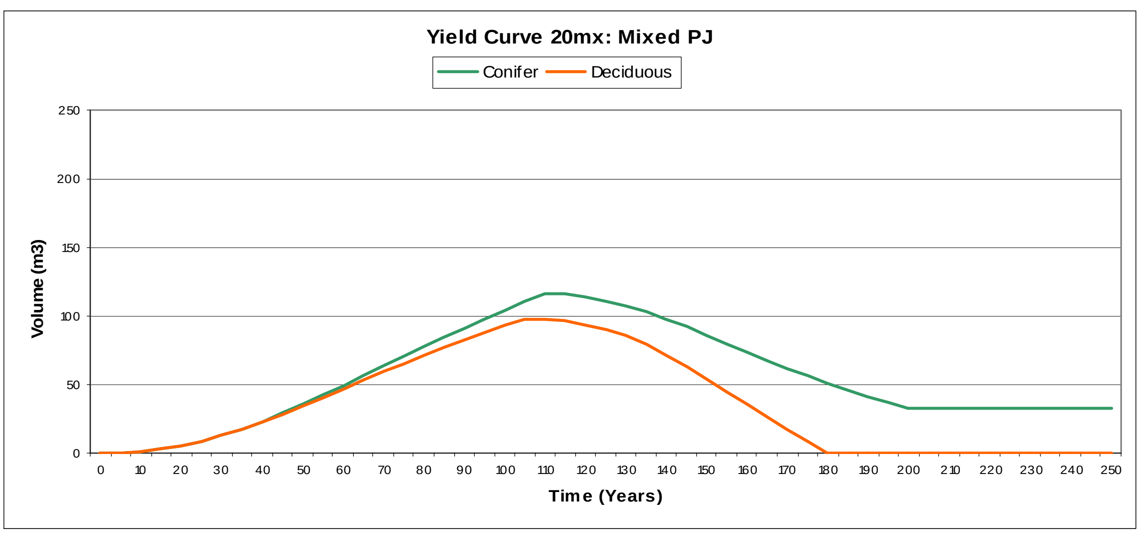

Yield Curve 3: SWAW
Conifer
Deciduous
Volume (m3)
Time (Years)

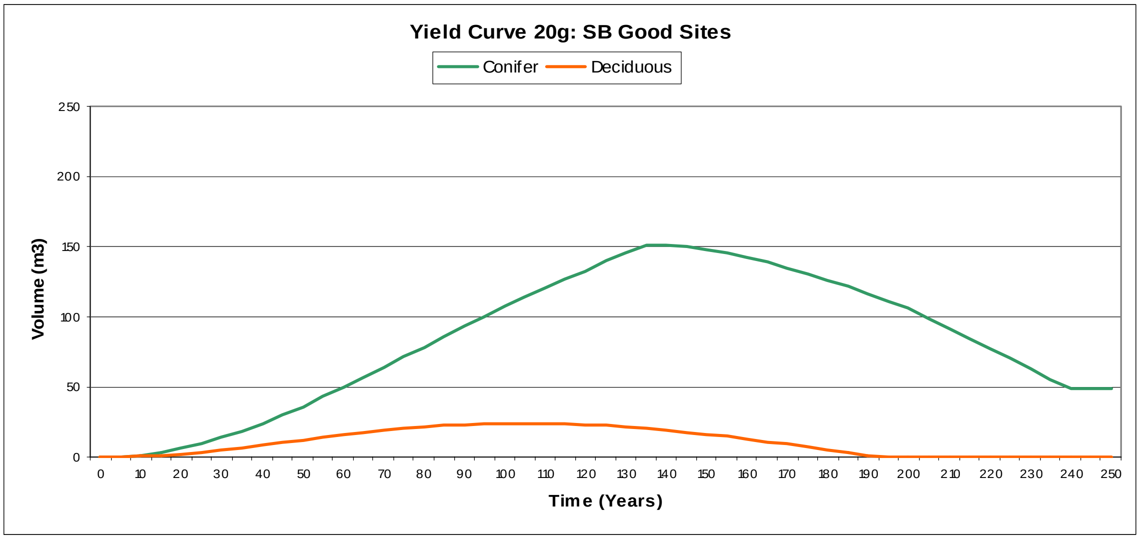

Yield Curve 4: SW
Conifer
Deciduous
Volume (m3)
Time (Years)

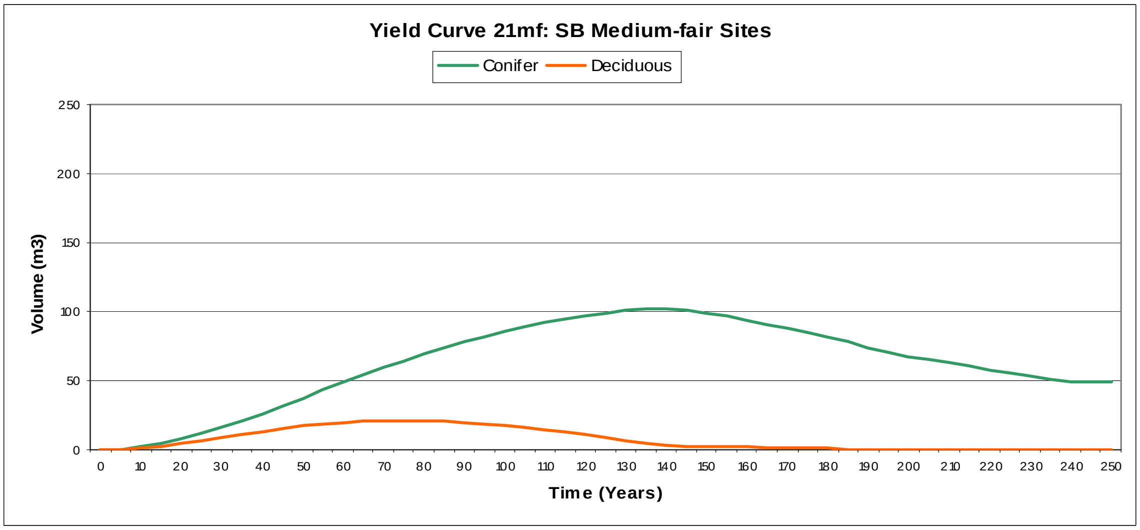

Yield Curve 5: Underplant and Clearcut of AW
Conifer
Deciduous
Volume (m3)
Time (Years)

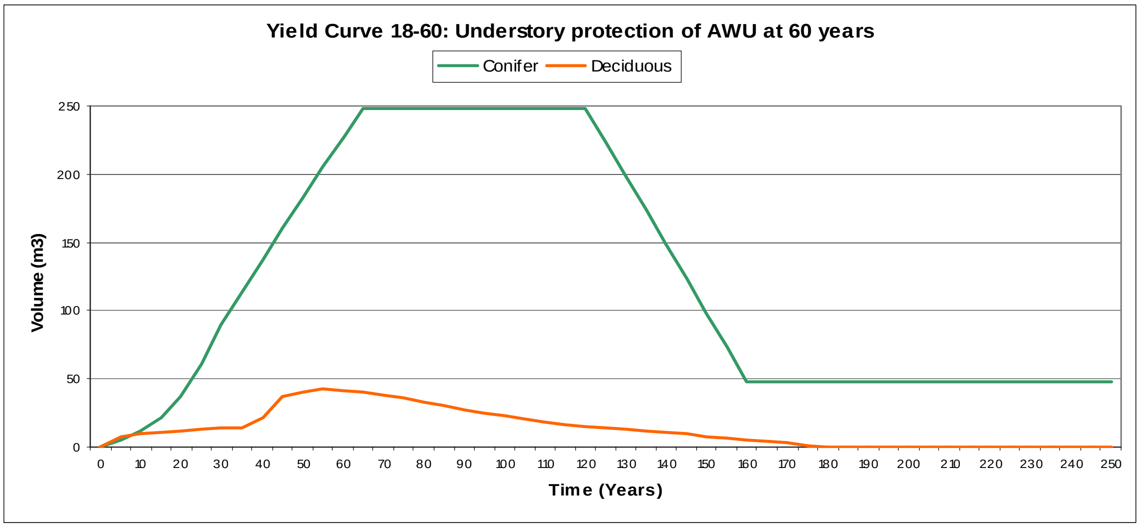

Yield Curve 9: Underplant and Clearcut of AWSW
Conifer
Deciduous
Volume (m3)
Time (Years)
0
50
100
150
200
250
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250

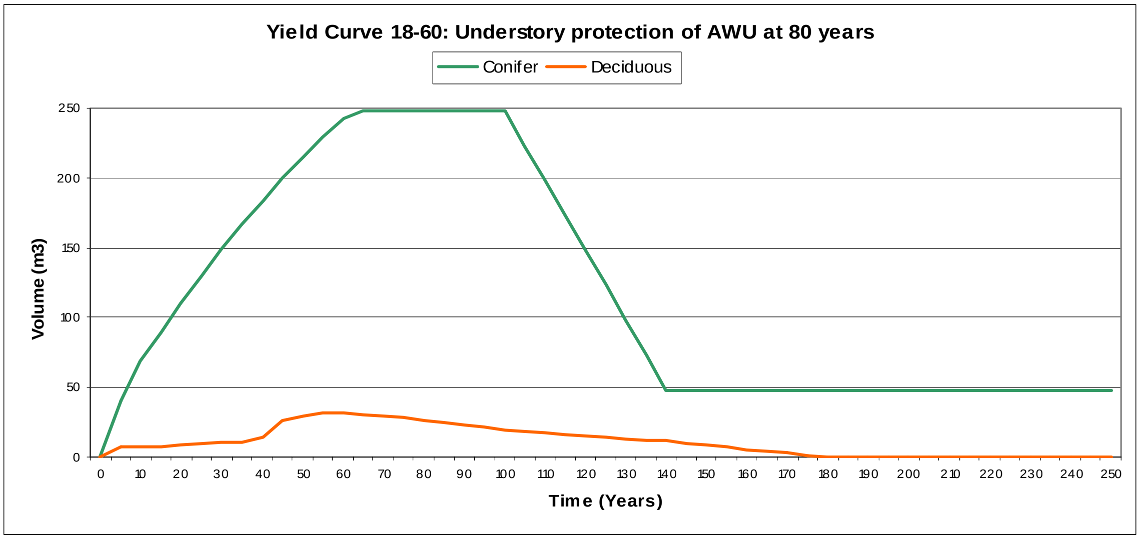

Yield Curve 20p: Pure PJ
Conifer
Deciduous
Volume (m3)
Time (Years)
0
50
100
150
200
250
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250

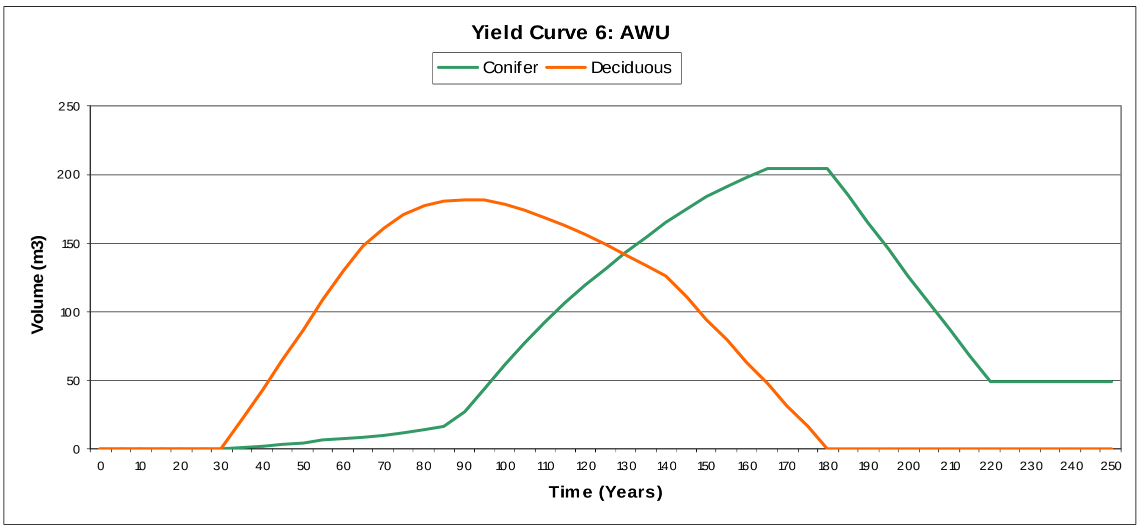

Yield Curve 20mx: Mixed PJ
Conifer
Deciduous
Volume (m3)
Time (Years)
0
50
100
150
200
250
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250


Yield Curve 20g: SB Good Sites
Conifer
Deciduous
Volume (m3)
Time (Years)


Yield Curve 21mf: SB Medium-fair Sites
Conifer
Deciduous
Volume (m3)
Time (Years)


Yield Curve 18-60: Understory protection of AWU at 60 years
Conifer
Deciduous
Volume (m3)
Time (Years)


Yield Curve 18-60: Understory protection of AWU at 80 years
Conifer
Deciduous
Volume (m3)
0
50
100
150
200
250
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250
Time (Years)


Yield Curve 6: AWU
Conifer
Deciduous
Volume (m3)
0
50
100
150
200
250
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250
Time (Years)

8. APPENDIX II: LANDBASE NETDOWN CODE (APRIL 2004)

8.1. COMBINE.AML

```
/* combine.aml
/* L1 landbase processing
/* step 1:  extract l1a, l1b, l1c, l1d and l1e compressed files into
arc info
/* step 2:  append l1a, l1b, l1c, l1d and l1e coverages together and
add new_link field
/* step 3:  union with existing harvest blocks, potential blocks,
compartments, etc
/* step 4:  post data to oracle for attribute calculation
/* step 5:  copy oracle processed data to l1_fin.themes info file
/* step 6:  temp file cleanup
/*
/*  Written by Bob Christian
/*  The Forestry Corp
/*

&arg routine

&wo c:\projects\p377\landbase_may2003

&if [null %routine%] &then
  &call USAGE

&call %routine%

&return

/***********************************
&routine USAGE
/***********************************

&type
&type &r process < CREATEALL | IMPORT | APPEND | UNION | ORACLEIN |
ORACLEOUT | CLEANUP | USAGE >
&TYPE
&type where
&TYPE CREATEALL: runs IMPORT, APPEND, UNION, ORACLEIN and CLEANUP
routines
&TYPE IMPORT: imports e00 and dbf files, also concatenates the
attributed files
&TYPE APPEND: mapjoins the coverage pieces
&TYPE UNION: adds in compartments and planned blocks
&type ORACLEIN: sends pat and att files to p377 oracle database
&type ORACLEOUT: brings back themes information from p377 oracle
database
&type CLEANUP: delete temporary coverages and info files
&type USAGE: this message
&type
&return &warning
```

```
/***********************************
&routine CREATEALL
/***********************************
/* loops through all the import routines
/*-----------------------------------------
&call import
&call append
&call union
&call oraclein
&call cleanup
&return

/***********************************
&routine IMPORT
/***********************************
/* loops through the five e00 and dbf files and imports into info
/*-----------------------------------------
&do sub &list a b c d e
      &if [exists l1%sub%_fin -cover] &then kill l1%sub%_fin all
      &if [exists l1%sub%_fin.att -info] &then killinfo l1%sub%_fin.att

      /* imports coverages from e00 files
      /*-----------------------------------------
      import cover l1%sub%_fin l1%sub%_fin

      /* imports info files from dbf files
      /*-----------------------------------------
      dbaseinfo l1%sub%_net_final.dbf l1%sub%_fin.att

      /* creates and assignes new_link field
      /*-----------------------------------------
      &if %sub% = 'a' &then &s link = 1000000
      &if %sub% = 'b' &then &s link = 2000000
      &if %sub% = 'c' &then &s link = 3000000
      &if %sub% = 'd' &then &s link = 4000000
      &if %sub% = 'e' &then &s link = 5000000
      tables
      additem l1%sub%_fin.pat new_link 8 8 i # link_key
      sel l1%sub%_fin.pat
      calc new_link = link_key + %link%
      additem l1%sub%_fin.att new_link 8 8 i # link_key
      sel l1%sub%_fin.att
      calc new_link = link_key + %link%
      q

      clean l1%sub%_fin
&end
&return

/***********************************
&routine APPEND
/***********************************
/* appends coverages together into one coverage

&if [exists l1_fin_temp -cover] &then kill l1_fin_temp all
&if [exists l1e2_fin -cover] &then kill l1e2_fin all
&if [exists l1e3_fin -cover] &then kill l1e3_fin all
```

```
&if [exists l1_fin.att -info] &then killinfo l1_fin.att

/* combines info files into one info file
/*------------------------------------------
&do sub &list a b c d e
      ap
      infofile l1%sub%_fin.att info l1_fin.att
      q
&end

/* removes small overlaps between J and non-J coverages
/*------------------------------------------
erase l1e_fin l1c_fin l1e2_fin poly
erase l1e2_fin l1b_fin l1e3_fin poly

/* append coverages together
/*------------------------------------------
mapjoin l1_fin_temp poly
l1a_fin
l1b_fin
l1c_fin
l1d_fin
l1e3_fin
end

&return

/************************************
&routine UNION
/************************************
/* unions landbase with harvest plans, compartments, etc

&if [exists l1_fin -cover] &then kill l1_fin
&if [exists l1_temp1 -cover] &then kill l1_temp1 all
&if [exists l1_temp2 -cover] &then kill l1_temp2 all
&if [exists l1_temp3 -cover] &then kill l1_temp3 all
&if [exists l1_temp4 -cover] &then kill l1_temp4 all
&if [exists l1_temp5 -cover] &then kill l1_temp5 all
&if [exists l1_temp6 -cover] &then kill l1_temp6 all
&if [exists l1_temp7 -cover] &then kill l1_temp7 all
&if [exists l1_temp8 -cover] &then kill l1_temp8 all
&if [exists l1_temp9 -cover] &then kill l1_temp9 all
&if [exists l1_temp10 -cover] &then kill l1_temp10 all

/* union landbase with additional coverages
/*------------------------------------------
union pre_blks_apr2004/alpac_032604
../compartment_revisions/comp_dec2002 l1_temp1 0.001   /* Al-Pac blocks
and compartment boundaries
union l1_temp1 ../vanderwell_pj/unit8_n27 l1_temp2 0.001 /* Vanderwell
PJ stands with incorrect ages
union l1_temp2 harv_blocks/mtu_2004_n27 l1_temp3 0.001   /* MTU 2004
blocks from SRD
union l1_temp3 harv_blocks/van_2004_n27 l1_temp4 0.001   /* Vanderwell
2004 blocks
union l1_temp4 harv_blocks/van_block_n27 l1_temp5 0.001  /* Vanderwell
2002 - 2003 blocks
```

```
union l1_temp5 harv_blocks/mtu_blk l1_temp6 0.001        /* MTU 2001 -
2002 blocks (harvested)
union l1_temp6 pre_blks_apr2004/mtu_032604 l1_temp7 0.001  /* MTU
blocks from Al-Pac
union l1_temp7 pre_blks_apr2004/too_steep l1_temp8 0.001  /* area
deemed to be too steep
dropitem l1_temp8.pat l1_fin_temp8.pat pass grid timber_id disp_holder
block_area optype status timb_num zone source block_num areaha
clip l1_temp8 l1_fin_temp l1_temp9
union l1_fin_temp l1_temp9 l1_temp10 0.001

/* eliminate small polygons (less than 200 m2)
/*-------------------------------------------
eliminate l1_temp10 l1_fin keepedge poly # area
res area < 200
[unquote '']
N
N

/* create and assign block_sps link field
/*-------------------------------------------
tables
additem l1_fin.pat block_sps 16 16 i # link_key
sel l1_fin.pat
calc block_sps = l1_fin#
q


&return


/***********************************
&routine ORACLEIN
/***********************************
/*disconnect oracle

/* connects to oracle and copies info files to oracle
/*-------------------------------------------
connect oracle p377/p377@oracle_hp

dbmsexecute oracle drop table l1_may2003_pat
dbmsexecute oracle drop table l1_may2003_att
infodbms oracle l1_fin.pat l1_may2003_pat
infodbms oracle l1_fin.att l1_may2003_att
disconnect oracle

&return


/***********************************
&routine ORACLEOUT
/***********************************
/*disconnect oracle

/* connects to oracle and copies oracle files to info
/*-------------------------------------------
connect oracle p377/p377@oracle_hp
```

```
&if [exists l1_fin.themes -info] &then killinfo l1_fin.themes
dbmsinfo oracle land_final l1_fin.themes
disconnect oracle

&return

/***********************************
&routine CLEANUP
/***********************************
&do sub &list a b c d e
      &if [exists l1%sub%_fin -cover] &then kill l1%sub%_fin all
      &if [exists l1%sub%_fin.att -info] &then killinfo l1%sub%_fin.att
&end
&if [exists l1_fin_temp -cover] &then kill l1_fin_temp all
&if [exists l1e1_fin -cover] &then kill l1e1_fin all
&if [exists l1e2_fin -cover] &then kill l1e2_fin all
&if [exists l1e3_fin -cover] &then kill l1e3_fin all
&if [exists l1_temp1 -cover] &then kill l1_temp1 all
&if [exists l1_temp2 -cover] &then kill l1_temp2 all
&if [exists l1_temp3 -cover] &then kill l1_temp3 all
&if [exists l1_temp4 -cover] &then kill l1_temp4 all
&if [exists l1_temp5 -cover] &then kill l1_temp5 all
&if [exists l1_temp6 -cover] &then kill l1_temp6 all
&if [exists l1_temp7 -cover] &then kill l1_temp7 all
&if [exists l1_temp8 -cover] &then kill l1_temp8 all
&if [exists l1_temp9 -cover] &then kill l1_temp9 all
&if [exists l1_temp10 -cover] &then kill l1_temp10 all


&return
```

8.2. CREATE_LAND_TEMP.SQL

```
REM  create_land_temp.sql
REM  script to create land_temp table from netdown coverage.

drop table land_temp;

rem Combine pat and att files
create table land_temp as
( select p.area, p.block_sps, a.nha, a.priha, a.horzha, p.l1_fin#,
p.l1_fin_id, p.link_key, p.new_link,
  a.ap_oper, a.entryyear, a.poly_num, a.density, a.height,
  a.tpr, a.nat_non, a.anth_veg, a.anth_non, a.udensity, a.uheight,
  a.usp1, a.usp1_per, a.usp2, a.usp2_per, a.usp3, a.usp3_per, a.usp4,
a.usp4_per, a.usp5, a.usp5_per,
  a.con, a.dec, a.ustems_ha, a.cgrp, a.ucon,
  a.udec, a.ucgrp, a.leadcon, a.uleadcon, a.st_num, a.ust_num,
a.strata, a.ustrata, a.net_strata,
  a.net_den, a.net_state, a.st_used, a.ex1, a.ex2, a.ex3, a.landbase,
a.net_season,
  a.curr_age, a.ucurr_age, a.net_p_age, a.cc_yr, a.g_cc_yr, a.q_cc_yr,
a.avi_yr, a.year_cut,
```

```
  a.cc_lb, a.har_cov, a.isol_flag, a.net_label, a.sw_sph, a.du_leadcon,
a.net_du, a.net_cgrp,
  a.fire_year, a.fire2002,
  p.comp_num, p.comp_label, p.mtu_yr, a.mgr, p.mtu_2004, p.van_pre,
p.van_2004, p.van_2002,
  p.year_class, p.log_year, p.m_year_class, p.m_log_year, p.steep
  from l1_may2003_att a, l1_may2003_pat p
  where a.new_link(+) = p.new_link);

commit;

rem add in new items for woodstock and Patchworks
alter table land_temp add
(thm1 char(8),
 thm1a char(8),
 theme1 char(8),
 theme2 char(8),
 theme3 char(8),
 theme4 char(8),
 theme5 char(8),
 theme6 char(8),
 theme7 char(8),
 tsa_age number(6),
 nha_per number(10,5),
 priha_per number(10,5),
 horzha_per number(10,5),
 n_ha float,
 pri_ha float,
 horz_ha float,
 tsa_sph number(4),
 pre_blk number(4),
 pre_seis char(8),
 core_strat char(8),
 core_mesic char(8)
 );


commit;
```

8.3. UPDATE_STEMS.SQL

```
rem update_stems.sql
rem calculate fields to use in determining the understory type
rem usp*_per is percent of understory as calculated in Al-Pac netdown
process
rem ustems_ha is understory stems per ha as calculated in Al-Pac
netdown process

update land_temp set tsa_sph = 0;

update land_temp set tsa_sph = tsa_sph + usp1_per where usp1 in ('Sw',
'Sb');
update land_temp set tsa_sph = tsa_sph + usp2_per where usp2 in ('Sw',
'Sb');
```

```
update land_temp set tsa_sph = tsa_sph + usp3_per where usp3 in ('Sw',
'Sb');
update land_temp set tsa_sph = tsa_sph + usp4_per where usp4 in ('Sw',
'Sb');
update land_temp set tsa_sph = tsa_sph + usp5_per where usp5 in ('Sw',
'Sb');

update land_temp set tsa_sph = tsa_sph / 10 * ustems_ha;


commit;
```

8.4. UPDATE_THEMES.SQL

```
rem theme1
update land_temp set theme1 = 'L1';
update land_temp set theme1 = 'OUTFMA' where link_key = 0;
update land_temp set theme1 = 'OUTFMA' where net_label = '0 AREA
OUTSIDE FMA';
update land_temp set theme1 = 'L1J' where theme1 = 'L1' and mgr = 'J';
update land_temp set thm1 = 'c' || comp_label where theme1 <> 'OUTFMA';
update land_temp set thm1 = 'c0' || comp_label where comp_num < 10 and
theme1 <> 'OUTFMA';
update land_temp set thm1 = 'c00' where comp_num = 0 and theme1 <>
'OUTFMA';
update land_temp set thm1 = 'X' where thm1 is null;


rem theme2
rem Overstory
update land_temp set theme2 = 'INOP';
update land_temp set theme2 = 'PJP' where leadcon = 'Pj' and con >= 8
and st_used = 'OVER';
update land_temp set theme2 = 'PJMX' where leadcon = 'Pj' and con < 8
and st_used = 'OVER';
update land_temp set theme2 = 'SB' where leadcon = 'Sb' and st_used =
'OVER';
update land_temp set theme2 = 'SB' where leadcon = 'Lt' and st_used =
'OVER';

update land_temp set theme2 = 'AW' where con <= 2 and dec > 0 and
st_used = 'OVER';
update land_temp set theme2 = 'AWSW' where con > 2 and con < 5 and
leadcon in ('Sw', 'Fb') and st_used = 'OVER';
update land_temp set theme2 = 'SWAW' where con >= 5 and con < 8 and
leadcon in ('Sw', 'Fb') and st_used = 'OVER';
update land_temp set theme2 = 'SW' where con >= 8 and leadcon in ('Sw',
'Fb') and st_used = 'OVER';

rem use understory as the main strata selection
************************
update land_temp set theme2 = 'PJP' where uleadcon = 'Pj' and ucon >= 8
and st_used = 'UNDER';
update land_temp set theme2 = 'PJMX' where uleadcon = 'Pj' and ucon < 8
and st_used = 'UNDER';
```

```
update land_temp set theme2 = 'SB' where uleadcon = 'Sb' and st_used =
'UNDER';
update land_temp set theme2 = 'SB' where uleadcon = 'Lt' and st_used =
'UNDER';

update land_temp set theme2 = 'AW' where ucon <= 2 and udec > 0 and
st_used = 'UNDER';
update land_temp set theme2 = 'AWSW' where ucon > 2 and ucon < 5 and
uleadcon in ('Sw', 'Fb') and st_used = 'UNDER';
update land_temp set theme2 = 'SWAW' where ucon >= 5 and ucon < 8 and
uleadcon in ('Sw', 'Fb') and st_used = 'UNDER';
update land_temp set theme2 = 'SW' where ucon >= 8 and uleadcon in
('Sw', 'Fb') and st_used = 'UNDER';

rem understory new definition
rem only White spruce and Black spruce can be understory
update land_temp set theme2 = 'AWU' where theme2 = 'AW' and st_used =
'OVER' and uleadcon in ('Lt', 'P', 'Pj', 'Pa', 'Pl', 'Sb', 'Sw', 'Se');
update land_temp set theme7 = 'X';
update land_temp set theme7 = 'N' where theme2 = 'AWU' and tsa_sph <
400;
update land_temp set theme7 = 'A' where theme2 = 'AWU' and tsa_sph >=
400 and tsa_sph < 600;
update land_temp set theme7 = 'Y' where theme2 = 'AWU' and tsa_sph >=
600;

update land_temp set theme2 = 'AWA' where net_state = 'ADEN';

commit;

update land_temp set theme2 = 'INOP' where theme2 is null;

rem where no AVI information is present, use Timberline strata
update land_temp set theme2 = 'AW' where theme2 = 'INOP' and net_strata
= 'Aw-S-C-S';
update land_temp set theme2 = 'AW' where theme2 = 'INOP' and net_strata
= 'Aw-S-O';
update land_temp set theme2 = 'AW' where theme2 = 'INOP' and net_strata
= 'Aw-comp';
update land_temp set theme2 = 'AWSW' where theme2 = 'INOP' and
net_strata = 'AwS-S';
update land_temp set theme2 = 'SWAW' where theme2 = 'INOP' and
net_strata = 'SAw-S';
update land_temp set theme2 = 'SW' where theme2 = 'INOP' and net_strata
= 'Sw-C-FM';
update land_temp set theme2 = 'SW' where theme2 = 'INOP' and net_strata
= 'Sw-C-G';
update land_temp set theme2 = 'SW' where theme2 = 'INOP' and net_strata
= 'Sw-O';
update land_temp set theme2 = 'PJMX' where theme2 = 'INOP' and
net_strata = 'Pj-O-C-FM';

rem theme3
rem update land_temp set theme3 = tpr;
update land_temp set theme3 = '1' where tpr = 'G';
update land_temp set theme3 = '2' where tpr = 'M';
update land_temp set theme3 = '3' where tpr = 'F';
```

```
update land_temp set theme3 = tpr where theme3 is null;
update land_temp set theme3 = 'X' where theme3 is null;

commit;

rem theme4
update land_temp set theme4 = 'REGEN' where cc_yr > 0;
update land_temp set theme4 = 'REGEN' where g_cc_yr > 0;
update land_temp set theme4 = 'REGEN' where q_cc_yr > 0;
update land_temp set theme4 = 'REGEN' where year_cut > 0;
update land_temp set theme4 = 'REGEN' where mtu_yr = '2001/2002';
rem update land_temp set theme4 = 'REGEN' where status >= 25 and status
<= 50;
update land_temp set theme4 = 'REGEN' where year_class = 'pre 2002';
update land_temp set theme4 = 'FIRE' where theme4 is null;

rem add back in cutblocks where tpr is U
update land_temp set theme3 = '2' where theme3 = 'U' and theme4 =
'REGEN';

rem theme5
update land_temp set theme5 = 'NONE';
update land_temp set theme5 = 'OIL' where net_label = '2.b Oil and
Gas';
update land_temp set theme5 = 'BURNT' where fire_year > 0;
update land_temp set theme5 = 'BURNT' where fire2002 = 'FIREX';

rem theme6
update land_temp set theme6 = 'UNSCH';
update land_temp set theme6 = 'NONOP' where ((ex1 <> 'NOEXCL' and ex1
<> 'GRA-RES' and ex1 <> 'PNT-MN') or
         (ex2 <>'NOEXCL' and ex2 <> 'CARIBOU') or ex3 <> 'NOBUF');
update land_temp set theme6 = 'NONOP' where theme3 in ('U', 'X');
update land_temp set theme6 = 'NONOP' where theme1 = 'OUTFMA';
update land_temp set theme6 = 'NONOP' where steep = 'yes';

update land_temp set theme6 = net_den where net_den in ('A', 'B', 'C',
'D') and theme6 = 'UNSCH';

rem core analysis strata
update land_temp set core_mesic = 'MX' where theme2 in ('AWSW',
'SWAW');
update land_temp set core_mesic = 'AW' where theme2 in ('AW', 'AWA',
'AWU');
update land_temp set core_mesic = 'SW' where theme2 = 'SW';
update land_temp set core_mesic = 'PJ' where theme2 in ('PJP', 'PJMX');
update land_temp set core_mesic = 'SB' where theme2 = 'SB';
update land_temp set core_mesic = 'INOP' where theme2 in ('X', 'INOP');

update land_temp set core_strat = core_mesic;
update land_temp set core_strat = 'Mesic' where core_mesic in ('AW',
'MX', 'SW');

rem pre-seismic strata
update land_temp set pre_seis = core_strat;

rem Remove Seismic
```

```
update land_temp set core_strat = 'INOP' where theme5 = 'OIL';
update land_temp set core_mesic = 'INOP' where theme5 = 'OIL';
update land_temp set theme6 = 'NONOP' where theme5 = 'OIL';


commit;
```

8.5. UPDATE_AGE_AREA.SQL

```
rem items cc_yr, q_cc_yr, avi_yr, g_cc_yr, year_cut indicate cutblocks
(use curr_age for cutblocks)
rem tsa age - in years for patchworks
update land_temp set tsa_age = 1;

rem tline is subtracting 1 from the currage to allow correct period
calcualtions, therefore, these ages will be off by one year.
update land_temp set tsa_age = curr_age where curr_age > 0;
update land_temp set tsa_age = ucurr_age where ucurr_age > 0 and theme4
= 'FIRE' and st_used = 'UNDER';
update land_temp set tsa_age = 2002 - cc_yr where cc_yr > 0;
update land_temp set tsa_age = 2002 - q_cc_yr where q_cc_yr > 0;
update land_temp set tsa_age = 2002 - avi_yr where avi_yr > 0;
update land_temp set tsa_age = 2002 - g_cc_yr where g_cc_yr > 0;
update land_temp set tsa_age = 2002 - year_cut where year_cut > 0;
update land_temp set tsa_age = 2002 - log_year where year_class = 'pre
2002';
update land_temp set tsa_age = 1 where mtu_yr = '2001/2002';
update land_temp set tsa_age = 1 where fire_year > 0;
update land_temp set tsa_age = 1 where fire2002 = 'FIREX';

rem Assign years to pre-block stands
update land_temp set pre_blk = 2002 where van_2002 = 'YES';
update land_temp set pre_blk = 2004 where van_2004 = 'YES';
update land_temp set pre_blk = 2004 where mtu_2004 = 'YES';
update land_temp set pre_blk = 2006 where van_pre = 'YES' and van_2004
is null;
update land_temp set pre_blk = log_year where year_class = '2002+
Planned' or year_class = '2002+ Harvested';
update land_temp set pre_blk = m_log_year where m_year_class = '2002+
Planned';

rem re-calc age for younger stands in planned block areas to make them
eligible for harvest
update land_temp set tsa_age = 61 where theme2 in ('AW', 'AWSW', 'AWU')
and pre_blk > 0 and tsa_age <= 60;
update land_temp set tsa_age = 81 where theme2 in ('PJP', 'PJMX', 'SW',
'SWAW') and pre_blk > 0 and tsa_age <= 80;
update land_temp set tsa_age = 121 where theme2 = 'SB' and pre_blk > 0
and tsa_age <= 120;

rem recalculate non-spatial areas based on old nha, priha and horzha
update land_temp set nha_per = nha / (nha + priha + horzha) where nha >
0;
update land_temp set priha_per = priha / (nha + priha + horzha) where
nha > 0;
```

```
update land_temp set horzha_per = horzha / (nha + priha + horzha) where
nha > 0;
update land_temp set nha_per = 1 where link_key = 0;
update land_temp set priha_per = 0 where link_key = 0;
update land_temp set horzha_per = 0 where link_key = 0;
update land_temp set n_ha = (area / 10000) * nha_per;
update land_temp set pri_ha = (area / 10000) * priha_per;
update land_temp set horz_ha = (area / 10000) * horzha_per;

rem reset thm1a to allow for 'J' control at compartment level
update land_temp set thm1a = thm1;
update land_temp set thm1a = 'nonJin' where theme1 = 'L1' and thm1 =
'c00' and theme2 in ('PJP','PJMX','SB','SW','SWAW','AWSW');
update land_temp set thm1a = 'nonJout' where theme1 = 'L1' and thm1 =
'c00' and theme2 in ('AW','AWU','AWA','INOP');
update land_temp set thm1a = 'preblk' where pre_blk > 0 or pre_blk < 0;


commit;
```

8.6. CREATE_LAND_FINAL.SQL

```
REM  create_land_final.sql
REM  script to create land_final table from land_temp table.

drop table land_final;

create table land_final as
select l1_fin#, block_sps, l1_fin_id, link_key, new_link, thm1, thm1a,
theme1, theme2, theme3, theme4, theme5,
theme6, theme7, tsa_age, nha_per, priha_per, horzha_per, n_ha, pri_ha,
horz_ha, tsa_sph, pre_blk, pre_seis,
core_strat, core_mesic
  from land_temp ;


commit;
```

9. MWM ADDENDUM - FMU L11 PREFERRED FOREST MANAGEMENT STRATEGY

(Note: Currently, available as a separate Portable Document File) (Will be added to final printed document after approval)

10. APPENDIX 3 – L1 TIMBER SUPPLY RUNS

(Note: Appendix 3 is available in digital format)