Mr. Tim Barker
Daishowa-Marubeni International Ltd.
Peace River Pulp Division
Postal Bag 4400
Peace River, AB T8S 1V7

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FOREST RESOURCES

January 31, 2012

Dear Mr. Barker,

This letter is Daishowa-Marubeni International, Peace River Pulp (DMI) Public Advisory Council's (PAC) summary of our input over the last 5 years, into the development of the current Detailed Forest Management Plan (DFMP). It answers two basic questions that DMI posed of us; firstly, what did we think of the process (with regards to our involvement), and secondly, do we support the DFMP that has been developed.

The current PAC members met Jan 12, 2012 to put together our views. Only 4 four of us were present, Laval Bergeron, Ricky Boucher, Mark Ladd and Clint Ostrom. Cheryl Anderson was not able to attend.

With regards to the first question:

- Overall we really liked and appreciated the educational phase of the process
- We very much appreciated Tim's constraints in keeping us focused on the issues we were able to deal with
- Overall we would have liked to see a more fine filter process rather the coarse filter one used.

- The initial structure of the PAC was very representative of the whole community, but as time went on and people dropped out, there didn't seem to be a push to replace them. (this was discussed at PAC meetings). With future PAC's or similar groups we would like DMI to do a sort of exit questionnaire with the people that leave, to determine reasons for the withdrawal, so that these issues can be resolved. This, in our opinion, would make any findings from the PAC much more valuable as there would be a larger input into any summaries.

- The development of the initial VOIT list was not too well received. We all felt that we were cut off before we had finished. Attempts were made later in the process to address this issue, but we feel that they were not completely successful

- We feel that some of our specific VOIT's that were slotted into pre-existing ones lost some of their nuances in translation. While DMI did a good job of illustrating to us how a pre-existing VOIT would cover our concern, we still feel that, in some circumstances, the specifics of our desires were lost.

- We still feel that we did not receive, in our minds, a valid reason for not including the VOIT's we requested with respect to maintaining a viable Grizzly Bear population.

- We felt the process took too long, and in the last 16 months or so there was a severe lack of communication from DMI as to what was going on.

- Overall we felt the process provided us with enough information and support to make meaningful contributions. We all felt that our opinions we received and considered.

- We would urge DMI that any future PAC's be made up of all concerned parties, and not separated into an ~~FMN~~ FWMI PAC and one that has all other stakeholders in it.

With regards the second question;

We see the proposed DFMP as being acceptable with one reservation. We are still not clear on how our VOITs ~~we~~ will be applied between the core and contingency areas. If all areas will have the VOIT's applied independently of each other, then we have no problem with the DFMP. But if presence of a particular VOIT in a contingency area will be used to offset its absence, or reduced percentage, in a core area, we have a problem with this.

Sincerely,

Mark Ladd (PAC Chair)

Laval Bergeron

Cheryl Anderson

Ricky Boucher

Clint Ostrom



DAISHOWA-MARUBENI INTERNATIONAL LTD.
Peace River Pulp Division

DMI Response to ASRD Net Land Base Approval Conditions Detailed Forest Management Plan

FMA 0900045 / FMA 0900044
2009-2018

April 21, 2012

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1 Background

1.1 West FMA First Net Landbase Submission

The net landbase documentation for FMA0900045 (FMA West) was first submitted in 2010. In May of 2010, as the forecasting document was being reviewed by the Plan Development Team, a possible problem was detected with the aging of the new AVI. The apparent change in ages (as compared to previous inventories) resulted in a much younger and a much more productive forest than past DFMPs suggested. It was mutually agreed upon by ASRD and DMI that the resultant AACs were risky until the aging issue was explainable.

The AVI ages were adjusted to match the 1989 origins and all work (net land base, yield forecasts, and forecasting) was replicated.

1.2 West FMA Second Net Land Base Submission

The Net Landbase Submission for FMA0900045 (west) was submitted on February 3, 2011. ASRD and DMI agreed that the west fma would be reviewed before the east fma would be submitted.

ASRD responded with a letter on April 1, 2011 (ASRD file #06298-F02-04) listing 14 points that required changes. The letter is attached as an appendix.

1.3 West FMA Third Net Landbase Submission

The Net Landbase Submission for FMA0900045 (FMA West) was submitted on August 15, 2011. This third submission contained all 14 amendments requested by ASRD in the April 1, 2011 letter.

The submission letter explaining the 14 points is presented as an appendix.

1.4 East FMA Net Landbase Submission

The Net Landbase Submission for FMA0900044 (FMA East) was submitted on August 23, 2011. This submission followed exactly the methodology used in the third West FMA net land base submission including the same treatment of the 14 points from the April1, 2011 ASRD letter.

1.5 Yield Curve Submission

The growth and yield program was designed and approved before the DMI FMA8900027 was split into two FMAs. The analysis was completed as a single piece of work to be applied to both new FMAs.

Following the 2010 review, ASRD requested that separate sets of yield curves be built for the east and west FMAs. The work was completed as one body of work that used indicator variable approach to produce two sets of curves. Therefore, there is one document covering Growth & Yield analysis for two FMAs. The exact same document is inserted into both DFMP submissions.

The Growth & Yield Information Package 2011 was submitted on September 14, 2011.

2 Yield Curve and Net Land Base Review

ASRD responded to the west FMA net land base, east FMA net land base, and yield curve submissions in a letter dated November 24, 2011 (ASRD file# 06298-R01-01).

The content of that letter is paraphrased below with the response to each item.

2.1 Yield Curve Review

"The department has completed its review of the Growth and Yield Information Package 2011 dated September 13, 2011. In general the documentation and procedures are consistent with discussions held with Daishowa-Marubeni International Ltd. (DMI) regarding planned localization of East Forest Management Agreement (FMA) versus West FMA yield estimates. The department was unable to replicate the steps taken with the data provided.

The findings are as follow: Yield Estimates"

Each item has been addressed and a new version of the growth and yield information package is submitted. Each of the items is also explained within the yield document.

1) Interpreted Alberta Vegetation Inventory (AVI) attribute data and resulting stratum assignment are not provided linked to the plot data. Origin and age were absent from the plot data.

Action: Resubmit data with interpreted AVI attributes, original origin, and modified origin attached.

DMI Reply: The requested data was present in the original submission but not clearly explained. We have determined that the correct data was used. The yield submission is amended to point out the requested data items. There is a net landbase amended flat table containing the requested data items.

2) Adjusted or modified AVI age is not documented in the "Growth and Yield Information Package 2011" (September 13, 2011). The stand origin field is referenced as AEP1991 but the data is not included.

Action: Document how modified origins/ages were used. Maintain the original and modified origins in the data.

DMI Reply: This is the same issue as #1. The yield curve submission explains the three requested data items. The new net landbase submissions contain appendix sections that explain where to find the requested items in the AVI tables and the flat table.

3) Data references 2007/2010 Microsoft Access format (i.e. .accdb), contrary to references made on page 7 and page 10 of the information package (i.e. .mdb).

Action: Editorial.

DMI Reply: Fixed in the new growth and yield information package.

4) Stratification description (page 21) is not consistent with SAS code. To align with stratification SAS coding (i.e. 04-019 STEP 5 - STRATIFICATION v2.sas), step 8, section 3.1.1 Landbase Criteria should read: "8. Succession Group: Forest stand that did not have a significant proportion of pine black spruce or Larch, OR that has a overstory broad cover group of "D" (i.e. [NF=0 and PXSBLT<=20% and uPXSBLT<=40%] OR (BCGo="D").)

Action: Editorial. Verify interpretation is correct and update document.

DMI Reply: It has been verified that the interpretation is correct – The wording has been changed to better reflect what was done.

5) Stratification description table 5 (page 22) for DU1, DU2 and DU3 are not consistent with the SAS coding (i.e. 04-019 STEP 5 -STRATIFICATION v2.sas). The reference "...at least 'A' density conifer tree species in the understory..." should read "...any presence identified in the understory layer of shade tolerant conifers (i.e. Fb, Sw and Sb)..." .

Action: Editorial. Verify interpretation is correct and update document. Review stratification description to ensure description and the coding are correct.

DMI response: The 'A' density term is used to denote that at least 6% shade-tolerant understory (AVI 2.1 specs.). The term 'any presence' would indicate shade-tolerant understorey between 1-6% cover could occur and is not the case. The wording in the new yield document is changed to "at least 6%" instead of " 'A' density" to avoid future confusion.

6) Reforestation Standard of Alberta (RSA) Mean Annual Increment (MAI) targets are not included in the Information Package.

Action: Include RSA MAI targets in the completed Forest Management Plan (FMP). Contact Lee Martins and Darren Aitkin to verify targets are properly defined prior to FMP completion.

DMI Response: The RSA MAI targets are submitted in a separate document. Darren Aitken was consulted prior to developing the submitted tables.

7) There are a number of broken reference links and tabular formatting issues in the information package: for example on pages 22, 25, 26.

Action: Editorial.

DMI Response: Fixed in new document.

8) The graph or reference is incorrect on page 94 (middle lower graphic).

Action: Editorial.

DMI Response: Fixed in new document.

2.2 Net Land base Review

The November 24, 2011 letter contained 17 points. Eight of the points are copied from the April 1, 2011 review and were addressed in the August 15/23, 2011 DMI submissions.

1) Align the age assignment in the yield stratification process with the age calculations in the landbase. Ensure the text and tables describe The AVI yield stratification process to allow its re-creation.

Action: Verify the text and table describing the AVI yield stratification process allow its re-creation.

Verify the adjusted AVI origins have been used in the growth and yield stratification process.

Item A) from April1, 2011 letter.

DMI Response: It is verified that the ages used in landbase and yield sections are consistent. The yield document has added documentation to address. The amended flat table contains all the required data items.

2) Confirm harvest area assignments are consistent with the Alberta Regeneration Information System (ARIS) validation procedures.

Action: Review April 12, 2011 email "Subject: DMI NET LANDBASE DOCUMENTATION REVIEW - Follow up - Harvest Area Assignment Expectations"

Included checklist/summaries to outline any inconsistencies with the Annex 1 Standard 3.11 and the ARIS Records Validation Procedures as required.

Item B) from April1, 2011 letter.

DMI Response: The status of the ARIS validation is presented in a separate document. Every reasonable attempt has been made to collect the required information. Checklists are provided.

3) Reference the origin update process (Adjustment of AVI Origin Year Values for 2011 DFMP Submission FMA0900044 and FMA0900045) in the land base document.

Action: Update the "Adjustment to AVI Origin Year Values for 2011 DFMP submission FMA0900044 and FMA0900045" to provide greater clarity around what stands were excluded from the process.

Item E) from April1, 2011 letter.

DMI Response: The August 15 / 23 submissions contained revised references to the the appendix containing the age update description. A new document that better explains which stands were excluded from the analysis is included in the August 23, 2011 submission and the newest submissions.

4) Add the required associated data field names and results to all landbase creation steps.

Action: Confirm all associated field names are referenced in the Query selection and outlined results.

Item F) from April1, 2011 letter.

DMI Response: This item was fully addressed in the August 15/23 submissions. ASRD review staff could not provide specific outages during this review.

5) Document changes caused by additional query steps in the text.

Action: Review all landbase creation steps and all associated field names and results (changes). Text, tables or figures are to provide sufficient detail to enable all queries be replicated.

Item G) from April1, 2011 letter.

DMI Response: This item was fully addressed in the August 15/23 submissions. ASRD review staff could not provide specific outages during this review.

6) Align flat file data dictionary field values with values found in the file.

Action: Per FMP Standard Annex 1 Section 1.2f, provide a description/definition for each valid code in Flat Table data dictionary.

Item H) from April1, 2011 letter.

DMI Response: This item was fully addressed in the August 15/23 submissions. ASRD review staff could not provide specific outages during this review.

7) Delete riparian buffers from the contributing / active land base.

Action: Ensure all associated field names are referenced in the Query selection and outlined results.

Delete remaining riparian buffers from the contributing/active landbase.

Ensure all query steps descriptions accurately reflect the access database query steps.

Item J) from April1, 2011 letter.

DMI Response: This item was fully addressed in the August 15/23 submissions. ASRD review staff could not provide specific outages during this review.

8) Confirm block regeneration codes align with values in the strata lookup table. See recommendation for item b) above.

Item N) from April1, 2011 letter.

DMI Response: This item was fully addressed in the August 15/23 submissions. ASRD review staff could not provide specific outages during this review.

9) Validation checklists

Action: Provide validated checklists for submitted components. Provide rationale to clearly outline areas where the standard is not achieved.

DMI Response: Done – all checklists provided by Robert Stokes upon specific request have been submitted.

10) Approved AVI - TPR and Origins included in final delivery.

Action: Confirm Annex 1 Standard 3.9.2 is met and all required attributes from the approved AVI, are included. Ensure the unadjusted origins and TPRs are included in the final Flat Table.

DMI Response: All required AVI attribute items are included in the submitted data tables. The clarification of adjusted versus un-adjusted origins is explained in the amended net land base documents. The amended flat tables contain the requested data items.

11) Require spatial inconsistencies, gaps and holes, in the dataset be removed.

Action: Confirm overlapping, and self intersecting polygons are corrected.

DMI Response: This item originally came up in 2010 when there were measureable errors in the shapefile creation steps. ESRI was unable to explain or fix the errors at that time. Immediately prior to the August 2011 submissions, ESRI provided a fix that seemed to eliminate most of the issue. There still remains some hidden flaw in shapefile creations that are beyond DMI to 100% eliminate. **DMI has not fully complied with this ASRD request – there are 7 errors present. They do not affect the TSA areas and thus have no bearing on the results of the modelling.**

Composite Forest Spatial Errors

After looking into the spatial integrity of the composite forest shapefiles, it was determined that there were 6 errors on the east-side FMA and 1 error on the west-side FMA. The following tables list the affected polygons and their associated areas in square metres.

East-Side FMA

cmpkey	**area (m^2)**
4047153	407.11561
4228671	370795.92088
4228675	168481.60161
4304402	3043.148053
4304405	40231.343316
4471002	0.000877

West-Side FMA

cmpkey	**area (m^2)**
3275179	0.148635

The ESRI ArcMap Fix Geometry tool was run to create new spatial shapefiles. The errors were fixed but the overall areas of the affected polygons do not change. The end result will be a shapefile for use in TSA with the same areas. It was deemed irrelevant and unnecessary to recreate all net land base and modeling steps (12 months work) in order to eliminate these miniscule irregularities.

12) Require documentation that other operators have been consulted.

Action: Provide documentation confirming operators were consulted and issues raised and addressed.

DMI Response: ASRD is an active member of the Plan Development Teams. Peace River ASRD staff will confirm that adequate consultation occurred. Each quota holder will provide a letter of support directly to Robert Stokes.

13) P1N AVI is greater than 10 years old.

Action: Document when / how Sustainable Resource Development (SRD) approved the use of old Forest Management Unit (FMU) P1 North AVI for this FMP.

DMI Response: This was discussed early in TOR discussions; however, DMI has no written documentation supporting use of this inventory. There is no other inventory available. P1N was added to the FMA after the opportune window for re-inventory passed. Thus DMI did not have responsibility for AVI collection during the years when the re-inventory would have been needed to meet this standard in 2009.

14) Landbase changes.

Action: Document the major differences between this landbase and the previous approved one.

DMI Response: Provided in Section 10 of the *Targets & Implementation* documents.

15) Detail Net Area Lost due to Seismic Line adjustments.
Action: Include a total row on "Area of Seismic Lines Removed from Net Landbase Table".

DMI Response: Done

16) Harvest area / disturbance ages.

Action: Ensure aging of harvest areas is consistent with past disturbances. Use the most current information (example: ARIS Reported Disturbance Dates, Clock Restart Date).

DMI Response: Cutover stratification used ARIS dates wherever present. The ARIS data is incomplete and suspect. Where ARIS aging was not possible, AVI calls were used.

17) Flat Table inclusion with deliverables. Action: Provide a copy of the Flat File with landbase at completion.

DMI Response: Done

Government of Alberta ■
Sustainable Resource Development

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Forest Management Branch
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www.alberta.ca

File: 06298 – R01-01

November 24, 2011

Tim Barker
Business Team Leader
Daishowa-Marubeni International Ltd.
c/o Peace River Pulp Division
Postal Bag 6500 Pulp Mill Site
Peace River Alberta T8S 1V5

Subject: **FOREST MANAGEMENT PLAN YIELD CURVE AND NET LANDBASE REVIEW**

Dear Mr. Barker,

The department has completed its review of the *Growth and Yield Information Package 2011* dated September 13, 2011. In general the documentation and procedures are consistent with discussions held with Daishowa-Marubeni International Ltd. (DMI) regarding planned localization of East Forest Management Agreement (FMA) versus West FMA yield estimates. The department was unable to replicate the steps taken with the data provided.

The findings are as follow:

Yield Estimates

1) Interpreted Alberta Vegetation Inventory (AVI) attribute data and resulting stratum assignment are not provided linked to the plot data. Origin and age were absent from the plot data.

> Action: Resubmit data with interpreted AVI attributes, original origin, and modified origin attached.

2) Adjusted or modified AVI age is not documented in the "Growth and Yield Information Package 2011" (September 13, 2011). The stand origin field is referenced as AEP1991 but the data is not included.

> Action: Document how modified origins/ages were used. Maintain the original and modified origins in the data.

3) Data references 2007/2010 Microsoft Access format (i.e. .accdb), contrary to references made on page 7 and page 10 of the information package (i.e. .mdb).

> Action: Editorial.

4) Stratification description (page 21) is not consistent with SAS code. To align with stratification SAS coding (i.e. *04-019 STEP 5 -STRATIFICATION v2.sas*), step 8, section *3.1.1 Landbase Criteria* should read:

8. Succession Group: Forest stand that did not have a significant proportion of pine black spruce or Larch, OR that has a overstory broad cover group of "D" (i.e. [NF=0 and PXSBLT<=20% and uPXSBLT<=40%] OR [BCGo="D"])

Action: Editorial. Verify interpretation is correct and update document.

5) Stratification description table 5 (page 22) for DU1, DU2 and DU3 are not consistent with the SAS coding (i.e. *04-019 STEP 5 -STRATIFICATION v2.sas*). The reference *"...at least 'A' density conifer tree species in the understory..."* should read *"...any presence identified in the understory layer of shade tolerant conifers (i.e. Fb, Sw and Sb)..."* .

Action: Editorial. Verify interpretation is correct and update document. Review stratification description to ensure description and the coding are correct.

6) Reforestation Standard of Alberta (RSA) Mean Annual Increment (MAI) targets are not included in the Information Package.

Action: Include RSA MAI targets in the completed Forest Management Plan (FMP). Contact Lee Martins and Darren Aitkin to verify targets are properly defined prior to FMP completion.

7) There are a number of broken reference links and tabular formatting issues in the information package: for example on pages 22, 25, 26.

Action: Editorial.

8) The graph or reference is incorrect on page 94 (middle lower graphic).

Action: Editorial.

Net Landbase

1) Align the age assignment in the yield stratification process with the age calculations in the landbase. Ensure the text and tables describe The AVI yield stratification process to allow its re-creation.

Action: Verify the text and table describing the AVI yield stratification process allow its re-creation.

Verify the adjusted AVI origins have been used in the growth and yield stratification process.

2) Confirm harvest area assignments are consistent with the Alberta Regeneration Information System (ARIS) validation procedures.

Action: Review April 12, 2011 email "Subject: DMI NET LANDBASE DOCUMENTATION REVIEW - Follow up - Harvest Area Assignment Expectations"

Included checklist/summaries to outline any inconsistencies with the Annex 1 Standard 3.11 and the ARIS Records Validation Procedures as required.

3) Reference the origin update process *(Adjustment of AVI Origin Year Values for 2011 DFMP Submission FMA0900044 and FMA0900045)* in the land base document.

Action: Update the "Adjustment to AVI Origin Year Values for 2011 DFMP submission FMA0900044 and FMA0900045" to provide greater clarity around what stands were excluded from the process.

4) Add the required associated data field names and results to all landbase creation steps.

Action: Confirm all associated field names are referenced in the Query selection and outlined results.

5) Document changes caused by additional query steps in the text.

Action: Review all landbase creation steps and all associated field names and results (changes). Text, tables or figures are to provide sufficient detail to enable all queries be replicated.

6) Align flat file data dictionary field values with values found in the file.

Action: Per FMP Standard Annex 1 Section 1.2f, provide a description/definition for each valid code in Flat Table data dictionary.

7) Delete riparian buffers from the contributing / active land base.

Action: Ensure all associated field names are referenced in the Query selection and outlined results.

Delete remaining riparian buffers from the contributing/active landbase.

Ensure all query steps descriptions accurately reflect the access database query steps.

8) Confirm block regeneration codes align with values in the strata lookup table.

See recommendation for item b) above.

9) Validation checklists

Action: Provide validated checklists for submitted components. Provide rationale to clearly outline areas where the standard is not achieved.

10) Approved AVI - TPR and Origins included in final delivery.

Action: Confirm Annex 1 Standard 3.9.2 is met and all required attributes from the approved AVI, are included. Ensure the unadjusted origins and TPRs are included in the final Flat Table.

11) Require spatial inconsistencies, gaps and holes, in the dataset be removed.

Action: Confirm overlapping, and self intersecting polygons are corrected.

12) Require documentation that other operators have been consulted.

Action: Provide documentation confirming operators were consulted and issues raised and addressed.

13) P1N AVI is greater than 10 years old.

Action: Document when / how Sustainable Resource Development (SRD) approved the use of old Forest Management Unit (FMU) P1 North AVI for this FMP.

14) Landbase changes.

Action: Document the major differences between this landbase and the previous approved one.

15) Detail Net Area Lost due to Seismic Line adjustments.

Action: Include a total row on "Area of Seismic Lines Removed from Net Landbase Table".

16) Harvest area / disturbance ages.

Action: Ensure aging of harvest areas is consistent with past disturbances. Use the most current information (example: ARIS Reported Disturbance Dates, Clock Restart Date).

17) Flat Table inclusion with deliverables.

Action: Provide a copy of the Flat File with landbase at completion.

Please contact Mr. Darren Aitkin (Yield Estimates) at 780-644-5581 or Mr. Jeremy Bluetchen (Net Landbase) at 780-644-8220 for further information.

Yours truly,

Robert W. Stokes, RPF
Senior Manager, Forest Planning Section

c.c. Daryl Price, Senior Manager, Resource Analysis Section
Darren Aitkin, Acting Manager, Forest Biometrics Unit
Jeremy Bluetchen, Resource Analyst
Mark Crowley, Senior Forester, Peace Upper Hay Area

DAISHOWA-MARUBENI INTERNATIONAL LTD.

Peace River Pulp Division

Net Landbase Documentation

Detailed Forest Management Plan 2009-2018

FMA0900045

(FMA West)

May 11, 2012

Version 2012-1

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1 PROJECT DESCRIPTION AND SUBMISSION COMPONENTS

1.1 BACKGROUND

Daishowa Marubeni International Ltd.'s Forest Management Agreement (FMA8900027) was replaced in 2009 with two new FMAs:

- *FMA West* (on the west side of the Peace River) consists of Forest Management Unit P19. FMU P19 is composed of the former FMUs P10, P13 (formerly P1S, P2, and P11), and p17 (formerly P1N). The old FMU designations are still used throughout this DFMP because management decisions and business arrangements still recognize their boundaries. The new P19 moniker will appear in all official allocations.

- *FMA East* (on the east side of the Peace River) consists of FMUs P3, P4, P5, S15, and F1.

When the growth & yield work was designed in 2005, there was only one forest administered under one FMA. After the yield curves were developed, the forest boundary was changed (FMU P1N was added) and the forest was split into two administrative forest management agreement areas. Consequently, there exists one set of yield curves to be applied in two DFMPs. ASRD directed DMI on a method to adjust yield curves for each FMA but the underlying data work is still one piece of work. Therefore, to properly review either of the yield curve adjusted sets, the entire net landbase (both east and west) is required. It is for this reason that the yield curve submissions are combined for the two FMAs.

Each FMA area will have a separate DFMP completed in 2011. However, the two DFMPs will share common Growth & Yield documents. There will also be one landscape assessment reusing the 1999 biophysical report originally completed on the whole of northwest Alberta.

This document presents the first stage of the 2011 DFMP submissions. Specifically, it covers net landbase determination for FMA West (FMA0900045).

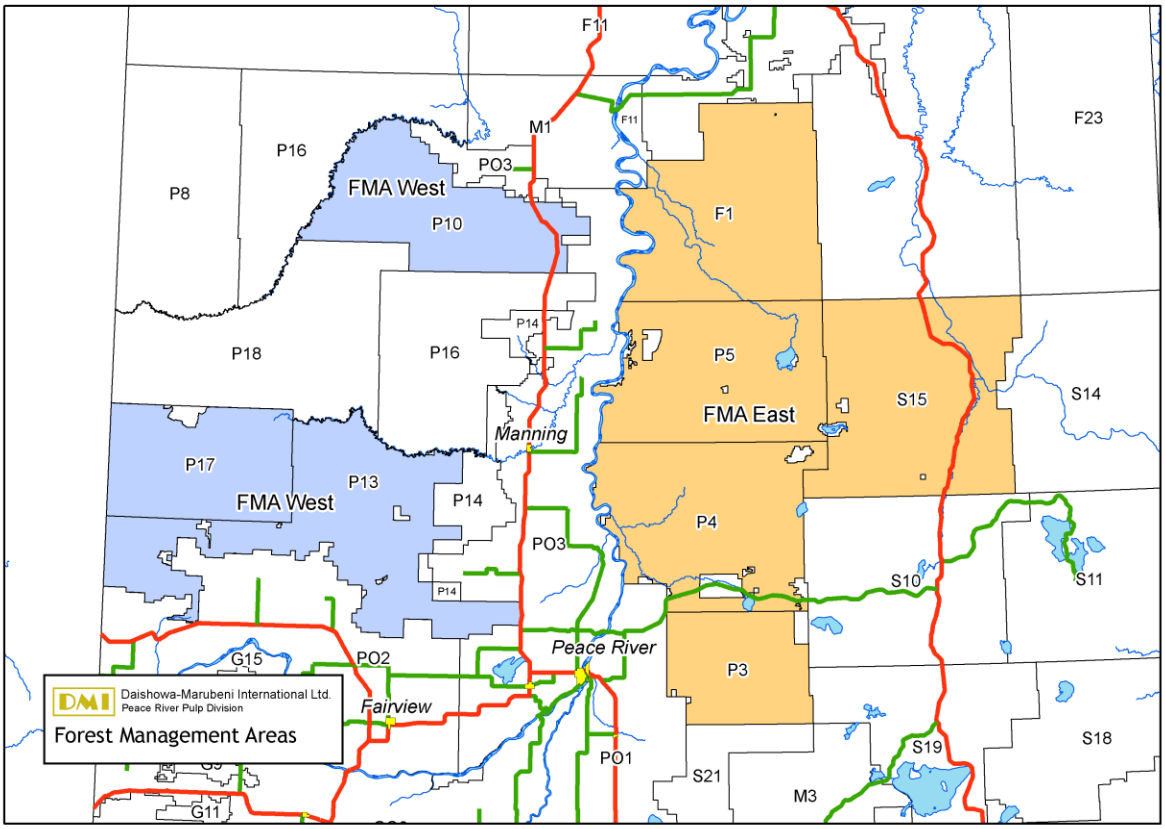


FIGURE 1-1 LOCATION OF THE TWO NEW FOREST MANAGEMENT AGREEMENT AREAS – FMA0900044 (FMAEAST) & FMA0900045 (FMA WEST).

1.2 SUBMISSION COMPONENTS

The net landbase procedure draws data from many sources, combines them, categorizes them, and formats them into output products to be used in subsequent Timber Supply Analyses (TSA). This submission contains all relevant data parts to be used in the TSA. It also contains a full description of all processing steps and intermediate data products.

The major components of this submission are:

- DVD(s) containing all data and processing databases
- Full documentation of all relevant processing steps:
    - Alberta Vegetation Inventory (AVI)
    - Spatial data processing
    - Cutover processing

- FMAWest net landbase calculation methods
- FMAWest net landbase summaries

1.3 SUBMISSION DATA ORGANIZATION

At this time (May 11, 2012) the submission is published on DVDs.

There are three main areas:

1) Composite forest
2) Documents
3) Stratification

1.3.1 COMPOSITE FOREST

The folder Composite Forest contains all relevant spatial data components that go into the final composite forest creation. The following zip files contain all inpuits and outputs of the spatyial processing steps:

- Composite.zip
- Finalinputs.zip
- Scripts.zip
- Water.zip

1.3.2 DOCUMENTS

The folder “documents” contains the following:

- Net Landbase West May11.pdf
- Report_ORIGIN_Adjust_APR2011.pdf
- submission letter May11_2012.pdf

1.3.3 STRATIFICATION

The folder ‘stratification’ contains three zip files:

- Avi.zip
- Cutover Stratification July2011.zip
- West Forest Stratify Aug2011.zip

Each of the zip files needs to be expanded. The details in the rest of this document explain the inner workings of each component.

2 DATA DESCRIPTION

DMI stores forest management related data in an integrated collection of Oracle databases. These include Genus (3rd party Oracle silviculture and operations tracking), VI (AVI storage and management Oracle database), ArcInfo (spatial and aspatial data), ArcSDE (Oracle storage platform for spatial data), and many others. These will collectively be referred to as the 'corporate' data bases.

The corporate databases are set up to allow a 'closed-loop' planning system on live data. The data submitted here are copies pulled out of the corporate database and the processes described within are duplicated here for the use of ASRD reviewers. Most of the processing steps described within this document are built into the corporate database and its related procedures.

DMI stores and uses digital data in a hierarchical fashion. Alberta Vegetation Inventory (AVI) data is the foundation of all forest planning activities. The AVI digital coverages are maintained as strictly vegetation inventories – there are no political, administrative, or decision-making layers incorporated within. Consequently, formulation of planning data requires a stepwise incorporation of updates and decision-making layers into the AVI base to produce a final *Composite Forest*. Composite forest layers are project specific because decision making layers differ between projects. Composite forest layers are time stamped to provide document control on status of inputs. Slivers created through the overlaying of layers are maintained in the composite forest, no dissolving of slivers was conducted.

All relevant data items from individual layers have been carried through to the final data attribute table. Thus, the spatial data layer (composite forest provided in shapefile format) used as the forest polygon layer in the TSA can be linked explicitly to any of the input data sources.

Spatial data is provided in shapefile format, ready for Woodstock/Stanley and Patchworks modeling. Data tables linked to the shapefiles are provided that summarize all relevant input items and all calculated items created in the stratification process.

Spatial data is compiled and edited in ArcGIS. Spatial data is submitted as final composite forest format. Individual input layers are available upon request if required.

Non-spatial data processing was completed in MS-Access using action queries and VB code. Complete copies of the working *.accdb files are provided in this submission. All relevant tables have been populated with metadata to describe item contents. VB code is self-documented.

2.1 ALBERTA VEGETATION INVENTORY (AVI)

DMI has completed two AVI inventories on its FMA limits since 1989. Both are stored in the corporate database. The aspatial AVI components are stored in an Oracle data structure that physically looks very different from the standard AVI (ostory, ustory, etc) table set. The corporate database is known as Vegetation Inventory (VI). VI1 stores the 1989 AVI. VI2 stores

the most recent AVI. Each VI instance contains all FMUs in northwest Alberta for which DMI has timber interests. VI1 and VI2 each have a corresponding spatial record set stored in SDE.

AVI is stored as a pure vegetation inventory. Political boundaries, biophysical features, updates and depletions are stored separately and combined with AVI as needed in separate products (see Section 3.0, Spatial Decision Making Layers).

AVI records have been extracted from VI and placed in the standard AVI tables for this submission. The supplied database *avi2_compiler.accdb* contains the processes for formatting the tables and calculating the processed fields (see Section 6.2 for AVI compilation description).

2.2 AVI STANDARD

The AVI used in these DFMPs was interpreted from 1:20,000 black and white photography and from 1:30000 soft-copy. The photography was flown in 1997, 2003, and 2004. The inventory was collected to Alberta Vegetation v2.1 Standard. Table 2-1 presents, for each FMU, the year photography was flown, the accuracy of the photography, the interpretation methodology, the date AVI was submitted to SRD and the date SRD approved the AVI. Copies of the approval letters have been provided in Appendix 1.

In each year subsequent to the inventory photo year, all of the blocks harvested within the FMA area are flown for 1:30,000 black and white photography and interpreted to AVI v2.1 standards. This data is stored in a separate data set and used in conjunction with the original vegetation inventory.

TABLE 2-1. ALBERTA VEGETATION INVENTORY APPROVAL STATUS BY FMU.

FMU	Photography Date	Accuracy	Interpretation Methodology	Submission Date	Approval Date
F1	2003	1:30000	Digital Stereoscopic	March 2008	*Pending*
P1S	2003	1:20000	Traditional stereoscopic	November 2004	August 2005
P1N	1997	1:20000	Traditional stereoscopic	April 2004	June 2004
P2	2003	1:20000	Traditional stereoscopic	March 2005	August 2005
P3	2004	1:20000	Traditional	April 2006	December 2007

FMU	Photography Date	Accuracy	Interpretation Methodology	Submission Date	Approval Date
			stereoscopic		
P4	2004	1:20000	Traditional stereoscopic	October 2007	July 2008
P5	2003	1:20000	Traditional stereoscopic	October 2007	May 2008
P10	2003	1:20000	Traditional stereoscopic	July 2005	October 2005
P11	2003	1:20000	Traditional stereoscopic	May 2007	June 2009
S15	2003	1:20000	Traditional stereoscopic	October 2007	December 2009

2.3 SPATIAL DATA

Most spatial datasets used for forest management at DMI are stored in ARC SDE on a network server. All relevant spatial layers and their accompanying attributes have been copied to file-based geodatabases for this submission. The final forest is exported to shapefile format for use in the TSA.

2.4 CUTOVER DATA

DMI performs annual cutover Soft Copy photo updates on all blocks harvested within the FMA areas. The blocks and adjacent impacted AVI stands are re-interpreted in this process. The resultant data is stored in the corporate database in SDE layers. The aspatial data associated with the blocks is stored in GENUS. The original 1989 AVI identified old cutovers in the modifier fields. These have been maintained spatially and are carried forward to this TSA. All affected quota holders were asked to provide their cutover data complete with ARIS records. This request was met to varying degrees by all quota holders. DMI completed a manual process of combining all cutover data sources into the *Blocks* geodatabase layer. In many cases, there were multiple data sources with conflicting data entries. DMI built the table BLK_DETAILS to store the final decisions made on all blocks. Decisions were made based on what was viewed as the best source and on local knowledge of the licenses involved. Every attempt was made to

complete the data entries so as to comply with *TSA Cutblock and regenerating landbase reconciliation Dec 02 09*.

2.5 YIELD CURVE INFORMATION

DMI developed successional yield curves in 1997. These have evolved through two revisions since then but maintain the basic principles of modeling aspen-white spruce succession. The growth and yield calculations to go with the successional pathways were recalculated in 2005, 2008, and again in 2011. The 2011 calculation utilized the new sampling plots completed as part of the new AVI collection.

The plot sample design and field procedures are described fully in *2005 Monitoring and G&Y Program (Sep. 14, 2006)*. The document *Growth and Yield Package 2011* will describe the final yield curve products to be used in the 2011 DFMPs.

The pathway assignments were calculated for each AVI polygon as part of the yield curve development process in 2011. The assignments were stored in the table '*VI_STRATA*'. This table is brought into each stratification process and the records copied across (ie the stratification routine for yield curve assignment is not re-run during forest stratification presented here – it was completed and fully documented in the yield curve submission).

3 AVI ORIGIN ADJUSTMENT

In May of 2010, initial modeling runs demonstrated a potential problem with the new AVI ageing approach. The AAC numbers coming from the new inventory suggested that average deciduous productivity was approximately double what it was in previous analyses.

It was mutually agreed by DMI and ASRD that an adjustment was warranted until such time as the problem could be explained. The DFMP process was slowed until an adjustment was determined. It was decided that the old 1990 AVI origins would be used.

On December 21, 2010, DMI submitted a document entitled ***Adjustment of AVI Origin Year Values for 2009 DFMP Submission (FMA0900044 and FMA0900045)*** . That document explained the process to adjust the inventory origins.

All origins and derived Timber productivity Ratings (TPR) used in this submission use the adjusted origin from the first AVI.

4 GENERALIZED DESCRIPTION OF PROCESSING STEPS

The final TSA dataset is built in a stepwise fashion using data from many sources. This section and Figure 4-1 describe the generalized steps involved in preparing the TSA dataset. The details are contained in subsequent sections.

4.1 AVI

The AVI contains several calculated fields commonly used in the preparation and implementation of the DFMP. The MS-Access file "avi2_compiler.accdb" is provided and explained in detail in Section 6.2. This component is submitted to document the calculation of processed fields.

4.2 GROWTH & YIELD

The growth and yield program is described in *2005 Monitoring and G&Y Program (Sep. 14, 2006)*. The Stratification of forest stands and statistical methods are described in *Growth and Yield Information Package 2008*. A revised G&Y package for 2011 will be submitted under separate cover along with this package.

4.3 CUTOVERS

The cutover information is manually pulled together from all stakeholders and calculated fields are processed as the first step in developing the TSA dataset. ARIS records were matched to DMI's spatial representations and data discrepancies were removed based on best knowledge of local history.

This preliminary processing created the *Blocks* spatial layer and the *BLK_DETAILS* aspatial table.

The resultant products are carried forward to subsequent stratification steps.

4.4 SPATIAL DECISION MAKING LAYERS

Every spatial layer required for decisions or reporting breakdown is organized into a data stack. A series of processes are performed to join the data into final spatial amalgamations.

4.5 COMPOSITE FOREST

The final spatial and aspatial dataset used in the TSA is called the “composite forest”. It is a composite of AVI with the spatial data stack complete with aspatial derived tabular data. In short, it brings all sources of required spatial data together with all required calculated fields and stratifications. This becomes the ‘working’ forest layer for all forest management during the life of the DFMP.

4.6 CUTOVER STRATIFICATION

The MS-Access file *cutover stratification july2011.accdb* contains the processing steps to stratify cutovers. All relevant block information is brought together with all relevant AVI and Yield information to perform a sequence of stratification steps. The final output product is a table (*cutover summary*) that is carried forward to the composite forest stratification.

4.7 FOREST STRATIFICATION

Separate composite forests were built for each FMA. The stratifications for both FMAs are the same but are presented here as individual processes. This will allow each FMA to be treated separately for the remainder of the DFMP processes. Data and documentation for one FMA will not be tied to the other DFMP process and approval.

The MS-Access file west *forest stratify july2011.accdb* contains the processing steps used to stratify each composite polygon. The final output is a summary table called *Model_Forest* which is a one-to-one table linking with the composite forest. It contains the final polygon stratifications to be used for TSA.

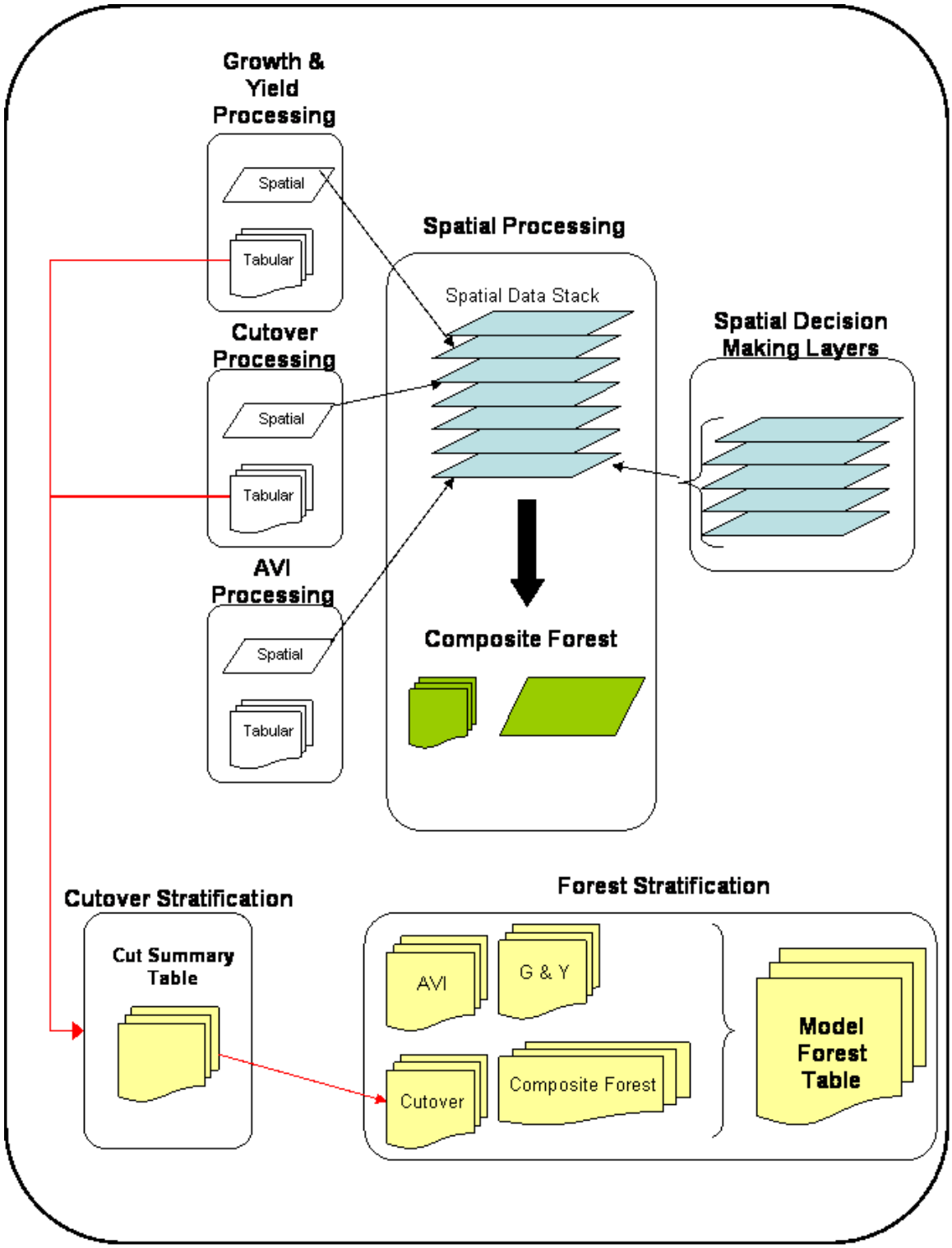


FIGURE 4-1. A GENERALISED DIAGRAM OF THE MAJOR PROCESSING STEPS INVOLVED IN FOREST STRATIFICATION.

5 SPATIAL DECISION MAKING LAYERS

A collection of spatial layers and accompanying tabular data was compiled for use in creation of the composite forest (*final_inputs.gdb*). Copies of the corporate database entities are presented in this submission.

The data stack is composed of the following layers:

Lubicon Traditional Area
Forest Management Agreement Area (DMI)
Caribou Special Management Zone
Moose Management Zones
First Nation Boundaries
Private land
DMI Operating Compartments
Grazing Areas
Parks
Incised Valleys and Steep Slopes
Research plots and Protective Notations
Hydrographic Buffer Areas (Including Swan nesting sites)
Historical Wildfires (Post AVI Collection)
Industrial Linear and Polygonal Disturbances
Cutblock Update (includes retention areas)
Seismic Lines and Trails
Forest Inventory (AVI)

There are two spatial datasets that have been used to assign attributes to composite forest polygons. These datasets are not part of the multi-union (do not split forest boundaries) but, rather, contribute attributes to the final product. These are:

Natural Sub-Regions of Alberta (modified)
HYDAT Gauging Station Catchment Areas

5.1 SPATIAL DATA PARAMETERS

The data used in this composite comes from a variety of sources including Government, DMI compiled, and Spatial Data Warehouse. ESRI's suite of GIS products was used exclusively for data manipulation and analysis. Because of software limitations, some datasets were split up into multiple components and then reassembled into the final datasets. Tolerances were set to ensure that data integrity was maintained at the highest level. Geodatabase resolution was maintained at 0.001m.

Datasets were clipped to a smaller geographic extent to reduce processing time for analysis. Although the final data structure is not affected by this boundary, this dataset has been included in the final set of data.

5.1.1 DATA STORAGE STRUCTURE

Data has been stored in ESRI File-Based GeoDatabases. This structure removes some of the limitations of shapefiles (i.e. field name truncation) and also eliminates the 2-GB size limit on personal geodatabases. A file-based geodatabase is stored as folders in a file system. Each dataset is held as a file that can scale up to 1TB in size. From this data storage format, individual pieces (e.g. FMU) can be extracted to meet the modeling software limitations.

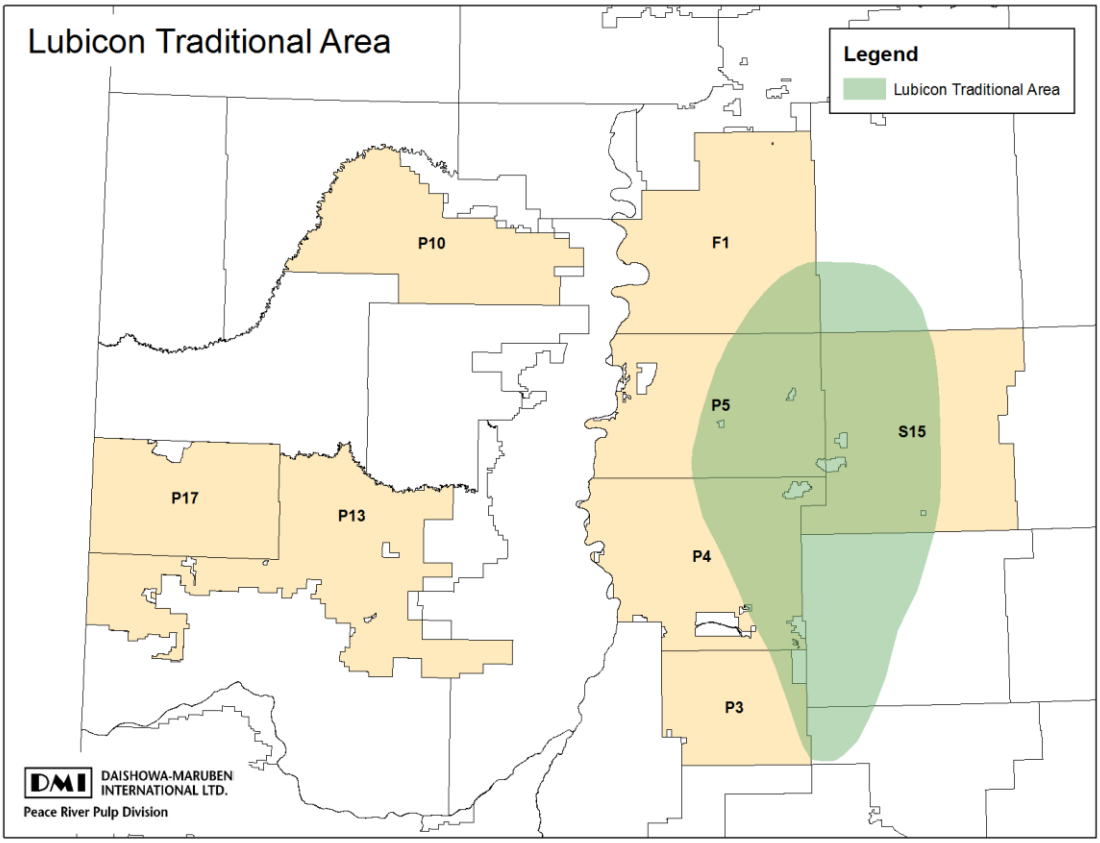
5.1.2 SPATIAL DATA COORDINATE SYSTEM

All data used in the production of the composite forest has been projected into the same coordinate system. This coordinate system (defined for all DMI data) is as follows:

Alias:
Abbreviation:
Remarks:
Projection: Transverse_Mercator
Parameters:
False_Easting: 500000.000000
False_Northing: 0.000000
Central_Meridian: -117.000000
Scale_Factor: 0.999600
Latitude_Of_Origin: 0.000000
Linear Unit: Meter (1.000000)
Geographic Coordinate System:
Name: GCS_North_American_1983
Alias:
Abbreviation:
Remarks:
Angular Unit: Degree (0.0174532925199433299)
Prime Meridian: Greenwich (0.000000000000000000)
Datum: D_North_American_1983
Spheroid: GRS_1980
Semimajor Axis: 6378137.000000000000000000
Semiminor Axis: 6356752.314140356100000000
Inverse Flattening: 298.257222101000020000

5.2 LUBICON TRADITIONAL AREA

(Feature class: *teardrop*)The Lubicon boundary originated from the original ERCB hearings with the Lubicon in 1990/1991. The boundary was part of the presentations and was digitized from a 1:250000 Government base map. Effective date for the boundary is 1991 with a spatial accuracy of +/- 7m (relative to the original document).

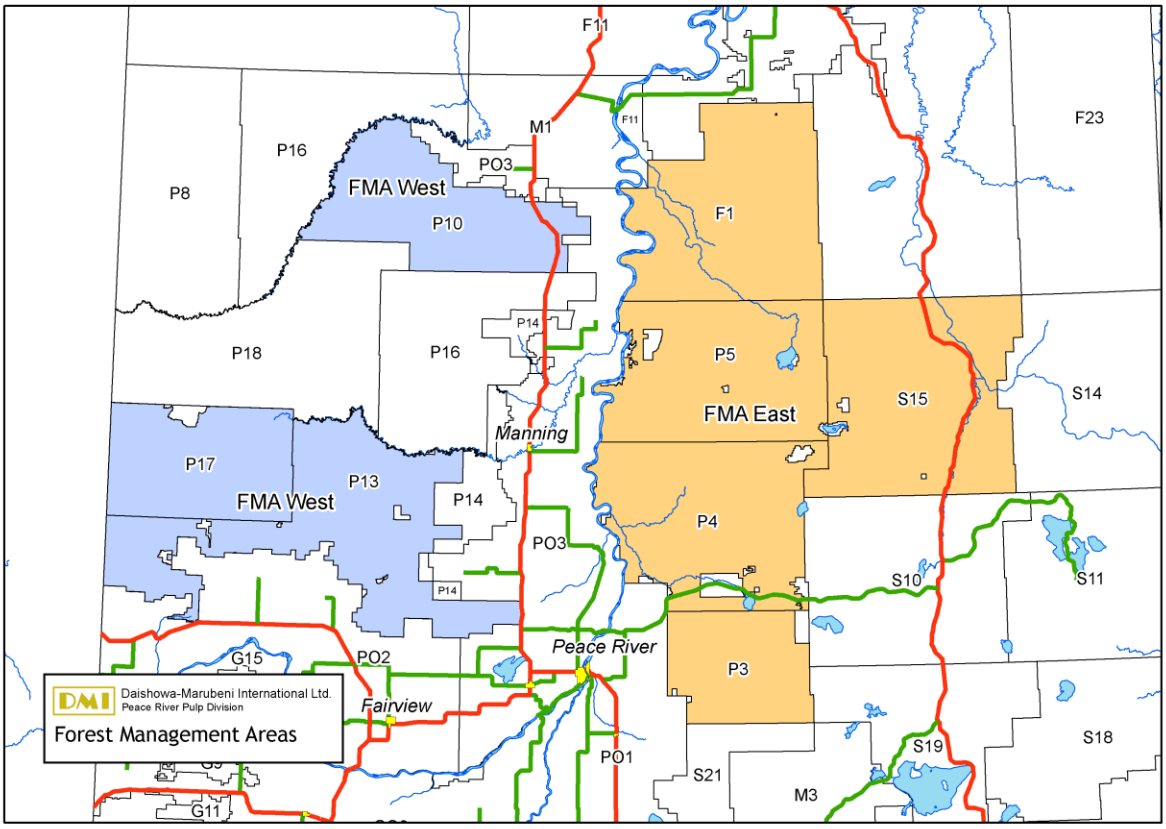


5.2.1 ATTRIBUTE INFORMATION

Field Name	Data Type	Width	Description
TEARDROP	Small Integer	2	Lubicon area of interest flag Valid values: 0 – no 1 - yes

5.3 FOREST MANAGEMENT AGREEMENT AREA

Feature class: *FMA*. These are the revised Forest Management Agreement areas as of July 28, 2009 showing the two Forest Management Areas (FMA0900044 and FMA0900045). Permanent deletions (Appendix 'A' deletions) appear as "holes" in the FMA. The Resource Analysis Section, Forest Management Branch, Forestry Division, SRD provided the FMA boundary. The effective date is July 28, 2009 with an accuracy of +/- 7m.

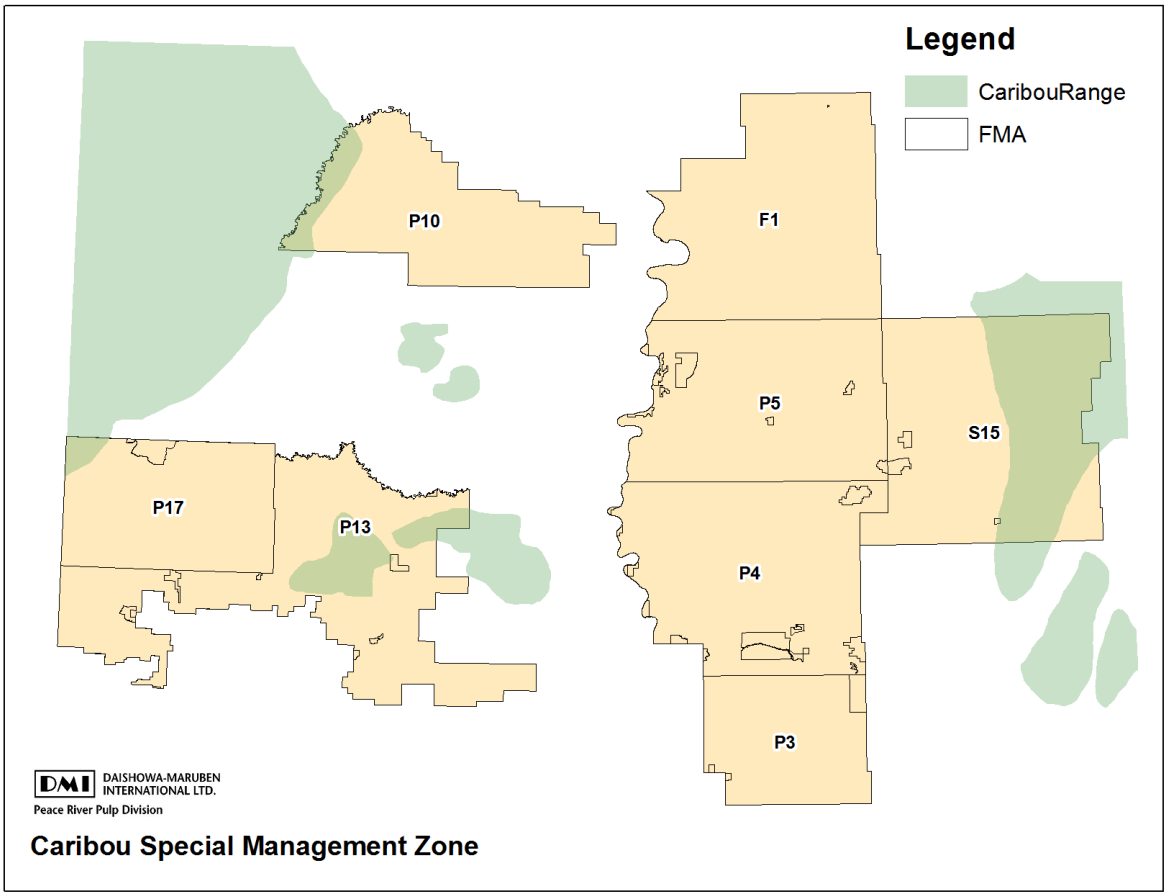


5.3.1 ATTRIBUTE INFORMATION

Field Name	Data Type	Width	Description
FMA	Small Integer	2	Forest Management Agreement Area Valid Values: 0 – no 1 - yes

5.4 CARIBOU SPECIAL MANAGEMENT ZONE

(Feature class: *caribou*). This dataset defines areas identified to be within the range of the Woodland Caribou. Original data source is Sustainable Resource Development, Fish & Wildlife Management with an effective date of October 25, 2010 and an accuracy of +/- 7m.

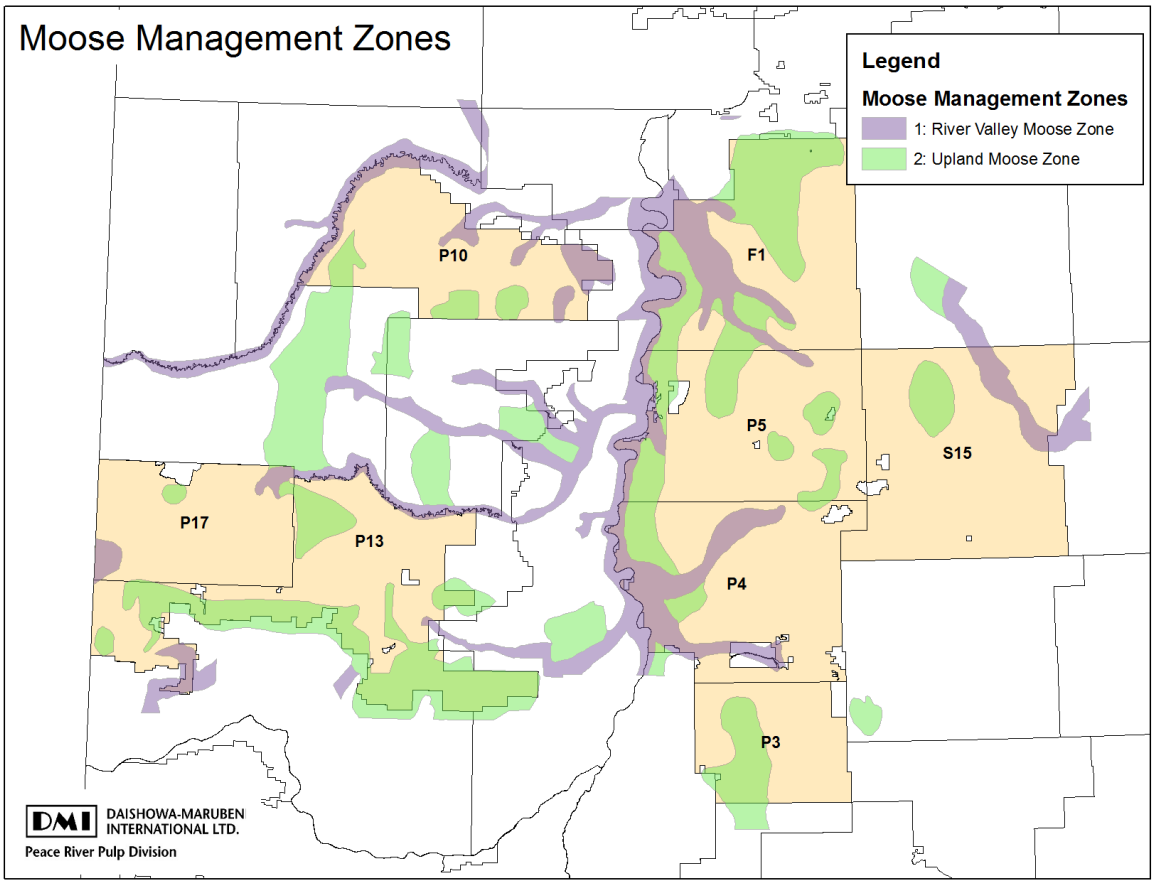


5.4.1 ATTRIBUTE INFORMATION

Field Name	Data Type	Width	Description
CARIBOU	Small Integer	2	Caribou range flag Valid values: 0 – no 1 - yes

5.5 MOOSE MANAGEMENT ZONES

(Feature class: *moose).* The label 'moose management' is a legacy that crept into practice by local planners many years ago. Rather than rework the corporate dataset, it is noted here that the proper reference for this dataset is ***NW3 – Peace Area Land Management Referral Map – Sept. 2006***. There are two features from the referral map that are used in operational planning. They are carried forward here into the composite for use in implementing the PFMS – they do not form any decisions during DFMP development. The two features are upland moose (*special access* on the original source) and River Valley moose (*winter ungulate* zone on original source). Original data source is Sustainable Resource Development, Fish & Wildlife Management with an effective date of October 2008 and an accuracy of +/- 7m.



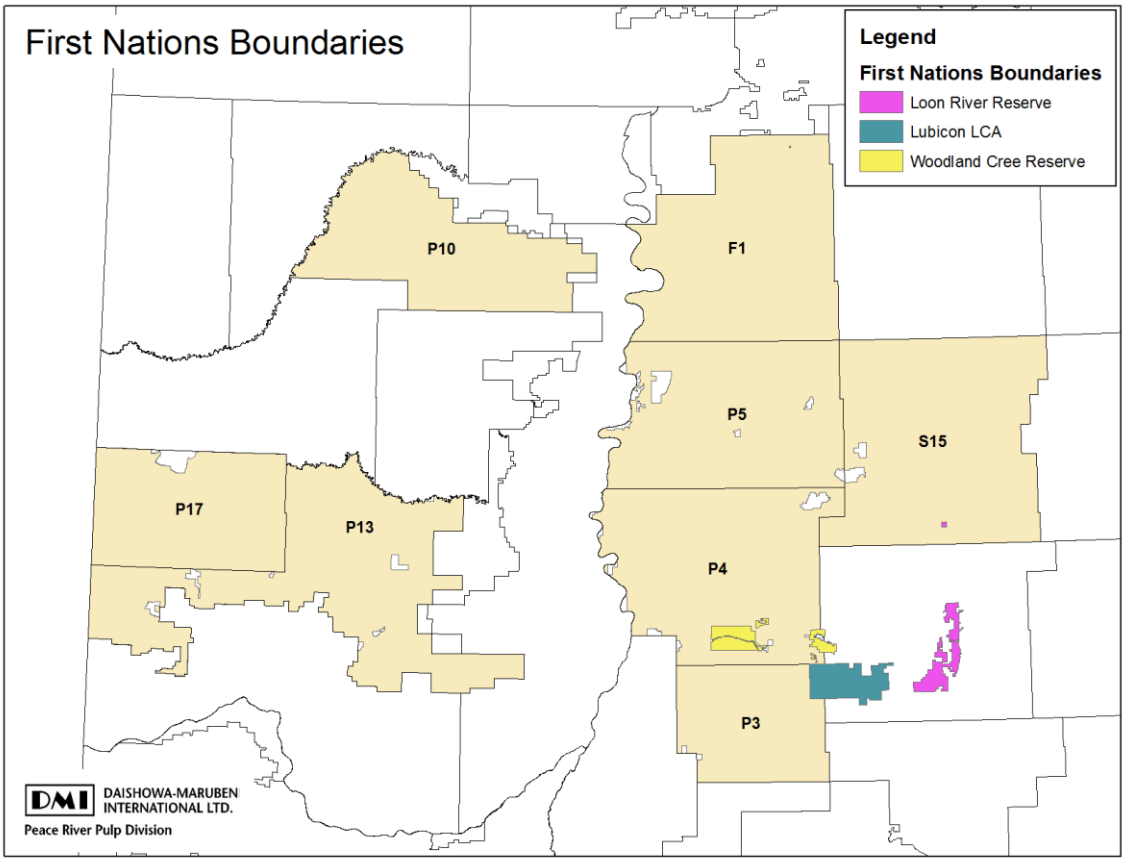
5.5.1 ATTRIBUTE INFORMATION

Field Name	Data Type	Width	Description
MOOSE	Small Integer	2	Moose habitat flag Valid values: 0 – no

Field Name	Data Type	Width	Description
			1 – River Valley Moose zone 2 – Upland Moose zone

5.6 FIRST NATIONS BOUNDARIES

(Feature class: *first_nations*). These are the First Nations Boundaries as defined by the Government of Canada. Loon River Cree and Woodland Cree are actual reserves with the Lubicon area defined as a settlement area. The data was originally purchased from the Provincial Government (now Spatial Data Warehouse). Minor updates have occurred since purchase to account for improved base data accuracy (water, lakes, roads, etc.) Effective date is October 2008 with an accuracy of +/- 7m.

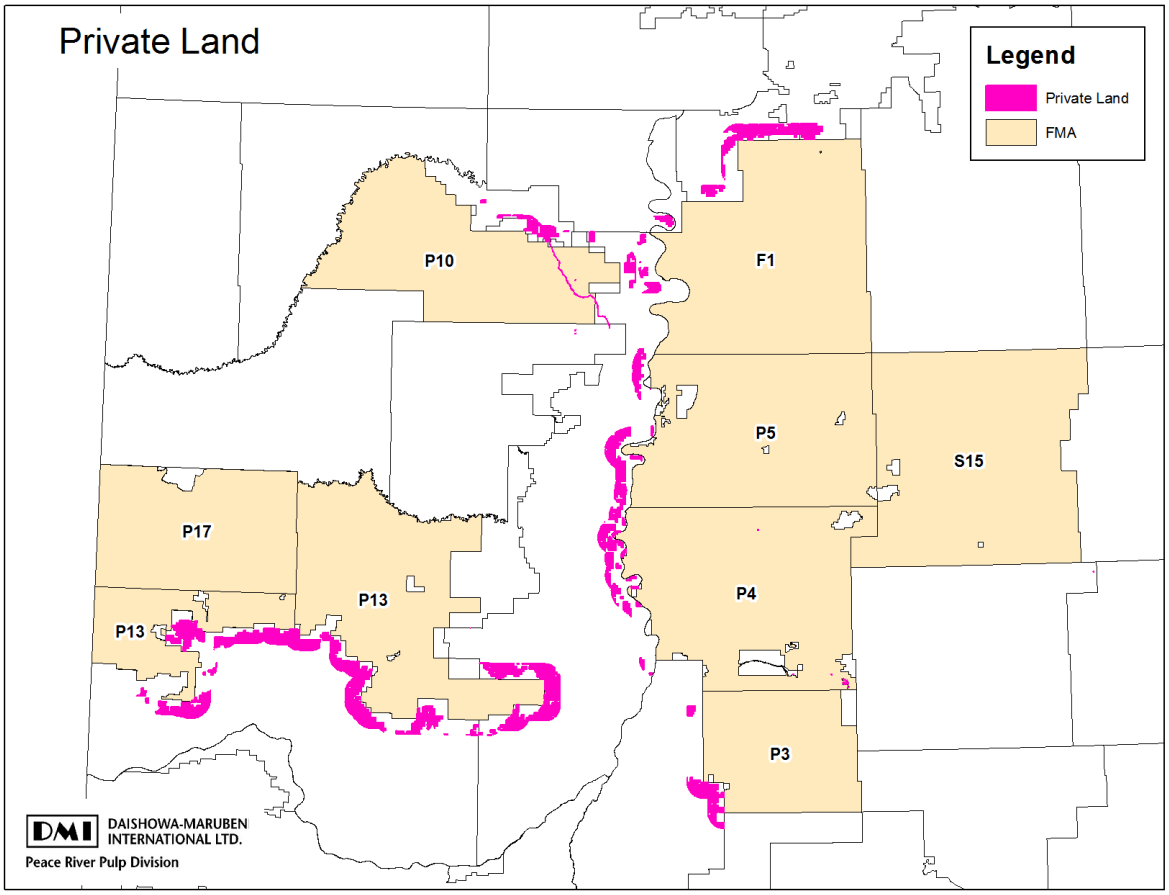


5.6.1 ATTRIBUTE INFORMATION

Field Name	Data Type	Width	Description
IRTAG	String	3	First Nations Reserve flag Valid values: LR – Loon River WC – Woodland Cree LUB - Lubicon

5.7 PRIVATE LAND

(Feature class: *private*). These are private (freehold) lands within and adjacent to the FMAs. Data was provided to DMI in shapefile format by ASRD on 13 April 2011. Effective date is April 2011 and accuracy is unknown. According to this layer, there are 130.5 ha of private land within the two FMAs. Any Landuse dispositions (feature class *landuse*, see Sec. 3.14) within private lands have been erased from the *landuse* layer.

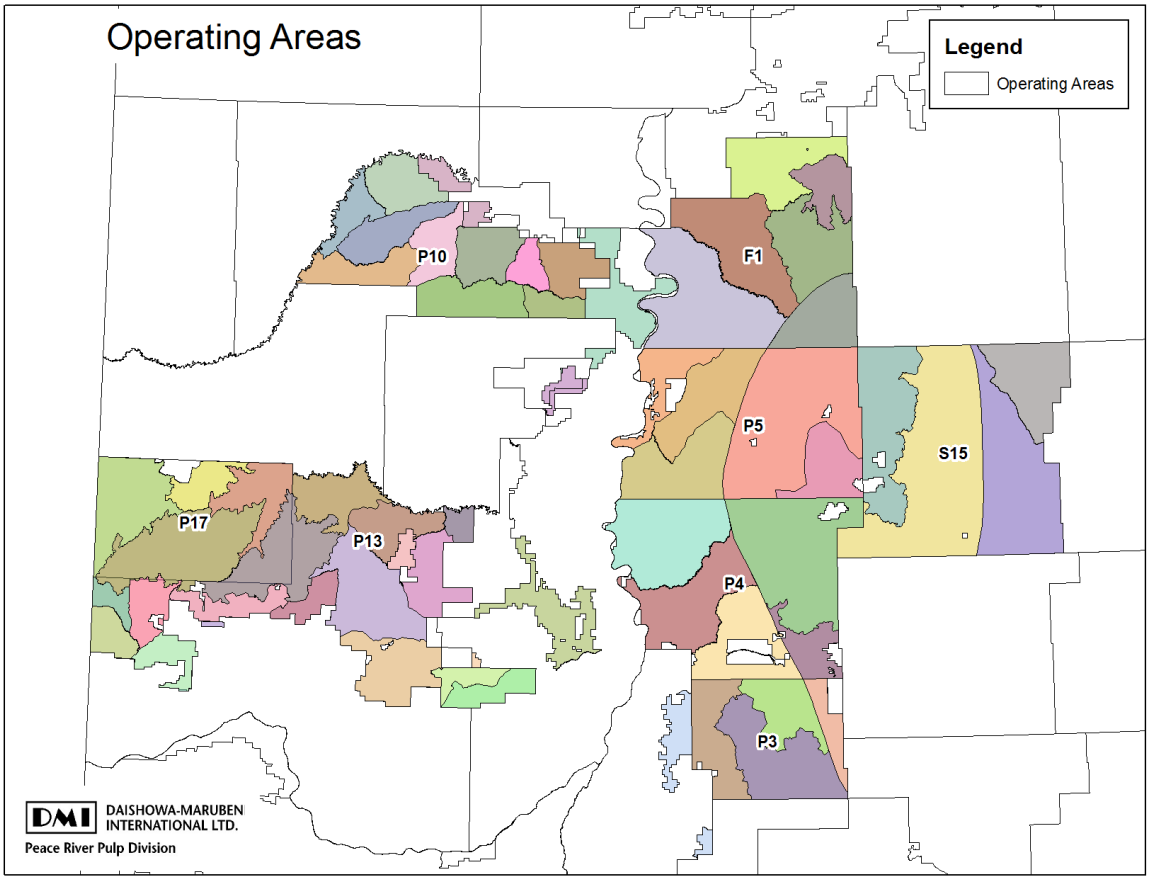


5.7.1 ATTRIBUTE INFORMATION

Field Name	Data Type	Width	Description
PRIVATE	Small Integer	2	Private land flag Valid values: 0 – no 1 - yes

5.8 OPERATING AREAS

(Feature class: *op_area*). DMI identified fixed spatial operating areas for operational planning in 2008. These areas will remain fixed and replace the former compartments and licences that were not spatially fixed over time. The new operating areas are built in a hierarchical fashion. Compartments are large regional planning units based on natural sub regions and political divisions. Compartments are subdivided by operating units. The hierarchy is noted in the naming convention.



5.8.1 ATTRIBUTE INFORMATION

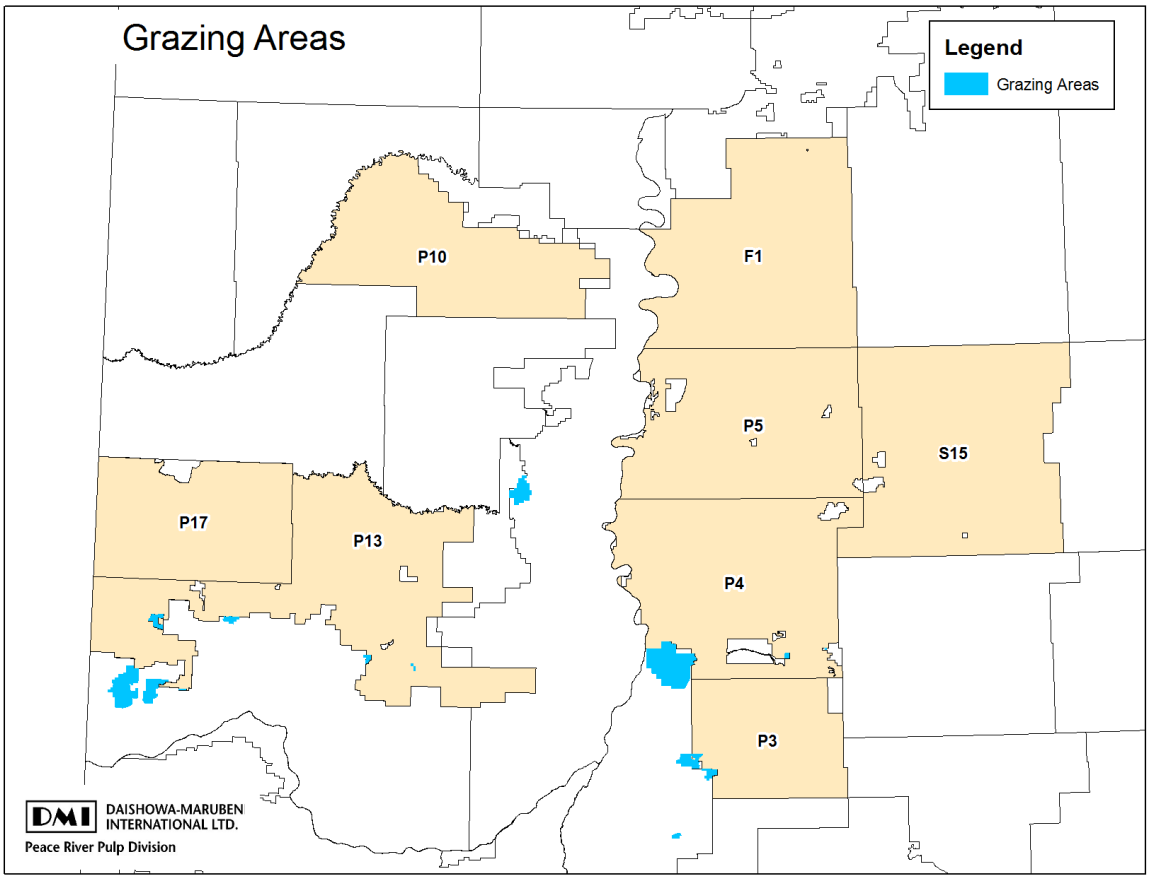
Field Name	Data Type	Width	Description
OP_AREA	String	25	Operating Area (DMI) Valid Values: BN-MearonC, BO-McLeanC, BO-SweenyC, BO-West, CC-HaroC, CC-West, CH-Worsley, CL-CadotteT, CL-

Field Name	Data Type	Width	Description
			HarmonValley, CL-HeartR, CL-SimonL, CR-ClearR, CT-BisonL, CT-HaigL, CT-LoonPrairie, CT-MartenR, CT-RossbearC, CT-RussellL, CT-SawnL, CT-South, DH-HinesC, DH-P2100, DH-WhitemudT, EP-BuffalR, EP-CacheC, EP-CarmonC, EP-KepplerC, EP-Sandhills, EP-WhiskeyJack, EP-WolverineC, KE-HawkHillsT, KR-BothaR, KR-KegR, KR-SmeatonC, KR-TwinL, KR-VaderC, KR-VestaC, LC-BuffaloHills, LC-BuffaloT, LC-MuddyR, NO-NotikewanR, RE-North, RE-South, RL-DoigR, RL-DoigT, RL-WhitemudR, ST-EurekaR, ST-RamblingC, ST-WhitemudR, SU-CubL, SU-EMEND, SU-NotikewinR, SU-P2200

5.9 GRAZING AREAS

(Feature class: *grazing*). These are all the areas that are under a grazing lease, license or reserve. The data originated from Government of Alberta survey plans with disposition information coming from LSAS Documentation. Effective date is October 2008 with an accuracy of +/- 7m.

All grazing areas that had any form of harvest restriction were removed from the FMAs with the 2009 revision. Thus, grazing is not a concern for the TSA or net land base – anywhere it was a concern has been removed. Note that there are portions of several grazing licenses, within which harvesting is permitted, that lie within the FMA boundary.



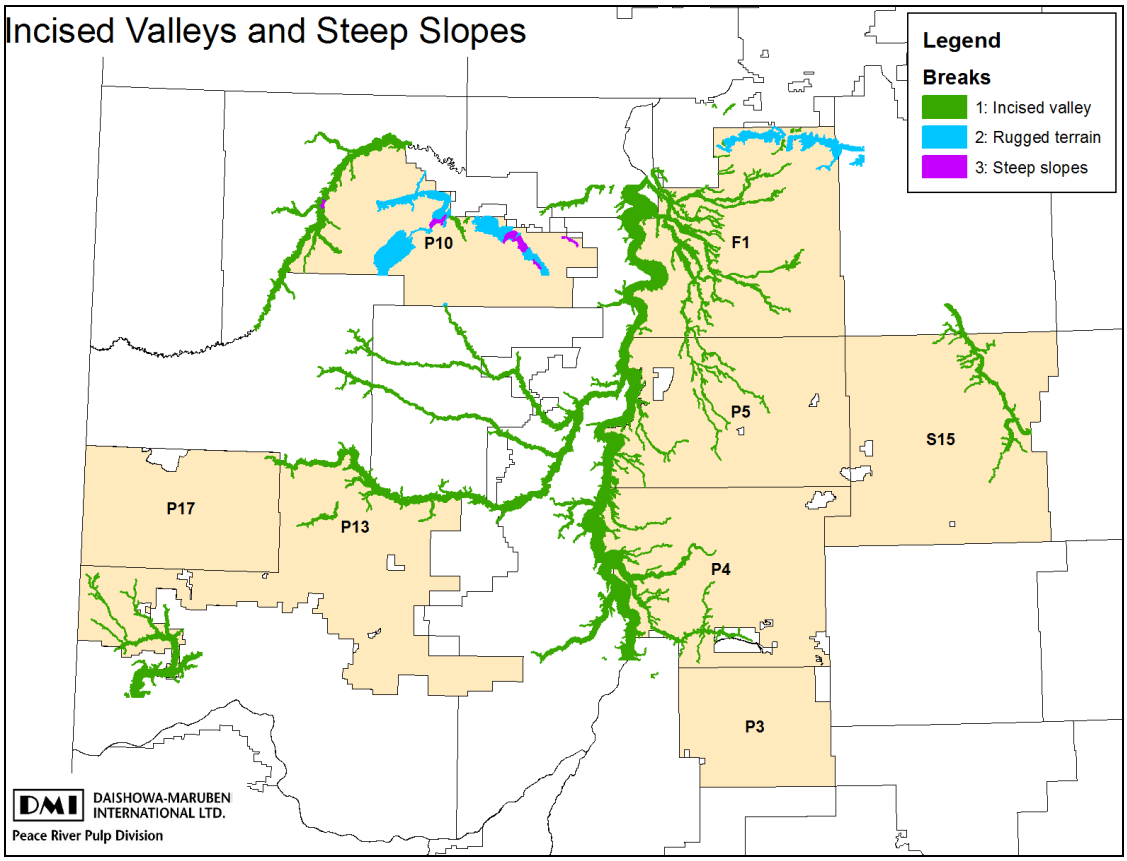
5.9.1 ATTRIBUTE INFORMATION

Field Name	Data Type	Width	Description
GRAZING	Small Integer	2	Grazing Area flag Valid values: 0 – no 1 - yes
GRAZING_KEY	Small Integer	2	Link to grazing dataset for further information

5.10 INCISED VALLEYS AND STEEP SLOPES

(Feature class: *breaks*).The areas here are either within incised valleys, too steep to operate, or rugged enough to have too high an operating cost. This data is an approximation of the actual boundaries and was manually digitized using base data such as contours and the forest inventory. Effective date is October 2008 with an accuracy of +/- 7m.

Codes 1 and 3 are used in the land base net down. Code 2, rugged terrain, is used after Preferred Management Scenario selection (PFMS) as a flag for operational planners during DFMP implementation.

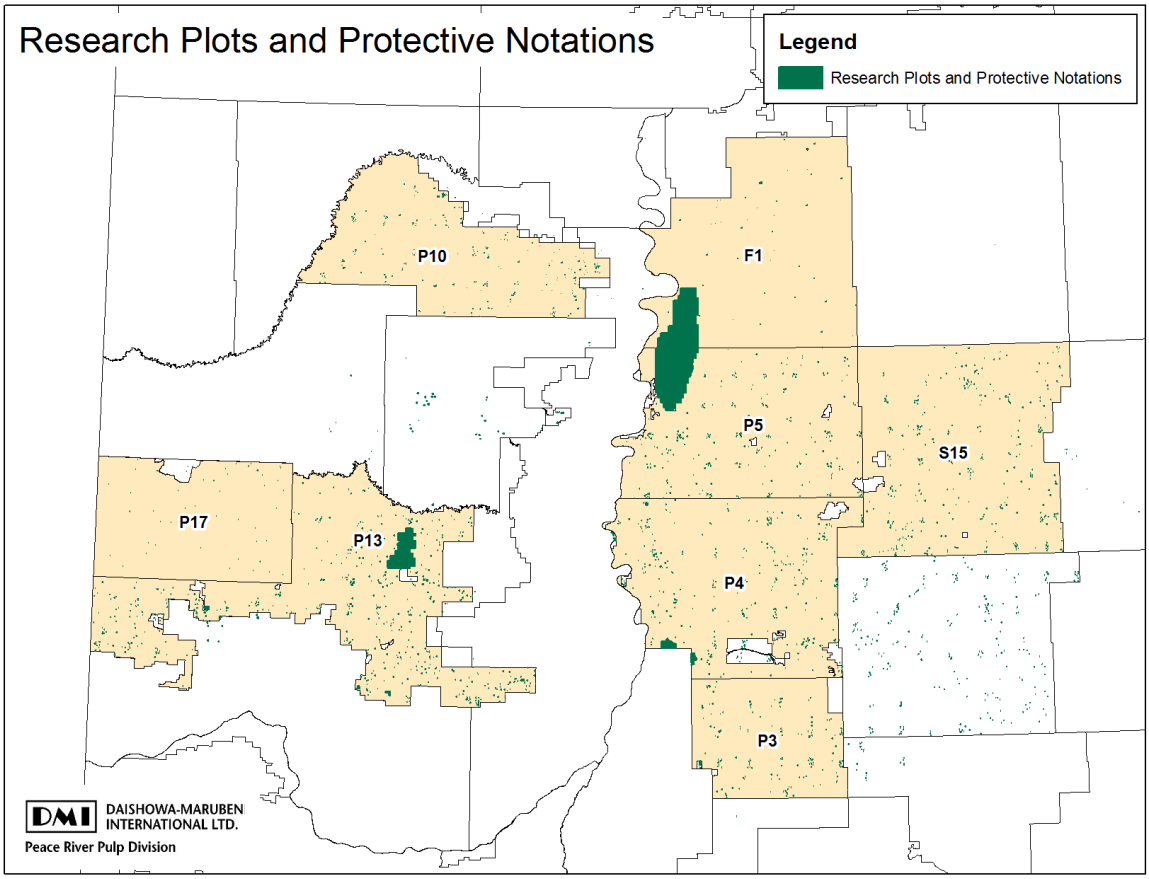


5.10.1 ATTRIBUTE INFORMATION

Field Name	Data Type	Width	Description
BREAK	Small Integer	2	Breaks flag Valid Values: 1 – Area within Incised valley 2 – Area of rugged terrain 3 – Area too steep to operate

5.11 RESEARCH PLOTS AND PROTECTIVE NOTATIONS

(Feature class: *reservations*).These areas are comprised of research areas, research plots, or protective notations (PNT). Harvest restrictions and/or notification requirements exist within these areas. Data originated from Provincial Government survey plans, LSAS Documentation and DMI internal data sources. Effective date is March 2010 with an accuracy of +/- 7m. There are 20 types of protective notifications represented on the two FMAs; the stratification process identifies those which are no-harvest (all except PNT950071, TSP2005, PSP2005, and TSP1999), and removes them from the active landbase.

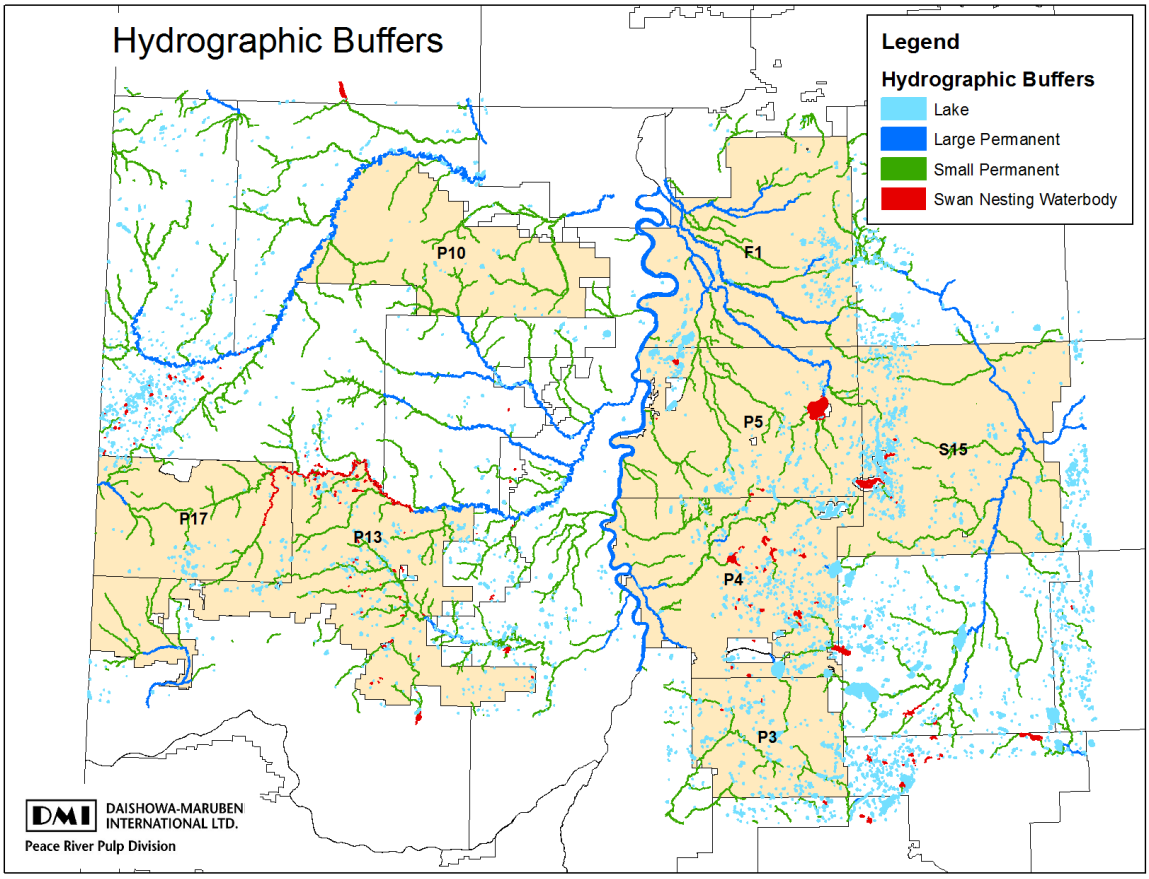


5.11.1 ATTRIBUTE INFORMATION

Field Name	Data Type	Width	Description
RESERVATION	String	10	Research plots and protective notations Valid values: CFS, EMEND, MWMA, NIVMA, PNT040360, PNT050181, PNT860691, PNT950071, PNT950172, PNT990009, PSP1990, PSP2005, PSPGOV, REC840004, REC840008, REC890026, REC950006, TSP1999, TSP2005, WESBOGY

5.12 HYDROGRAPHIC BUFFER AREAS (INCLUDING SWAN NESTING SITES)

(Feature class: *hydrobuf*).This data is a composite of buffered rivers, buffered permanent streams, buffered lakes and buffered swan nesting sites. Individual buffer layers have been added together with larger buffers having higher precedence. The resultant layer contains no overlap of buffer types. The input hydrography layers were originally purchased from the Provincial Government (now Spatial Data Warehouse) in 1989. Lakes and flooded areas from the AVI were incorporated as input layers for lake buffers.



Minor updates have occurred since purchase to account for improved base data accuracy and to accommodate AVI interpreted water. Swan data originated from Sustainable Resource Development, Fish & Wildlife Management. Effective date is October 2010 with an accuracy of +/- 7m.

All the input features used in ctreating the *hydrobuf* lauyer have been provided in the geodatabase *water.gdb*.

NOTES - Hydro contains not only the water buffers (lakes and streams), but also the swan nesting sites buffers.

a. Swan nesting sites - The new polygon layer representing water bodies known to have swan nesting sites was downloaded from the ASRD website on Oct. 25, 2010. This replaces the point feature layer previously used in the earlier versions of the composite forest. Lakes and flooded areas in the AVI that intersected swan nesting sites were buffered by 200m and were used to represent nesting sites. Nesting sites that did not intersect AVI lakes or flooded areas will be protected at the operational level but are not represented in the composite forest.

Bison Lake in P5 was identified as a nesting site. The Wolverine River, which flows out of Bison Lake, is represented in the lakes polygon layer and is a feature that does intersect the new Swan nesting layer, but the Wolverine River was not included in the composite forest because the Bison Lake polygon was used to represent the swan water body, and there were no nesting sites associated with the river itself.

The Notikewan River on the north edge of P13 is also a polygon feature in the DMI lakes layer, and there were five swan nesting sites that intersected this river, therefore the entire polygon feature was included in the composite and given the appropriate buffer.

b. Lakes - These are all bodies of water that are not double-sided streams or rivers and are buffered by 100 metres.

c. Large Permanent - These are all double-sided streams and rivers and are buffered by 60 metres.

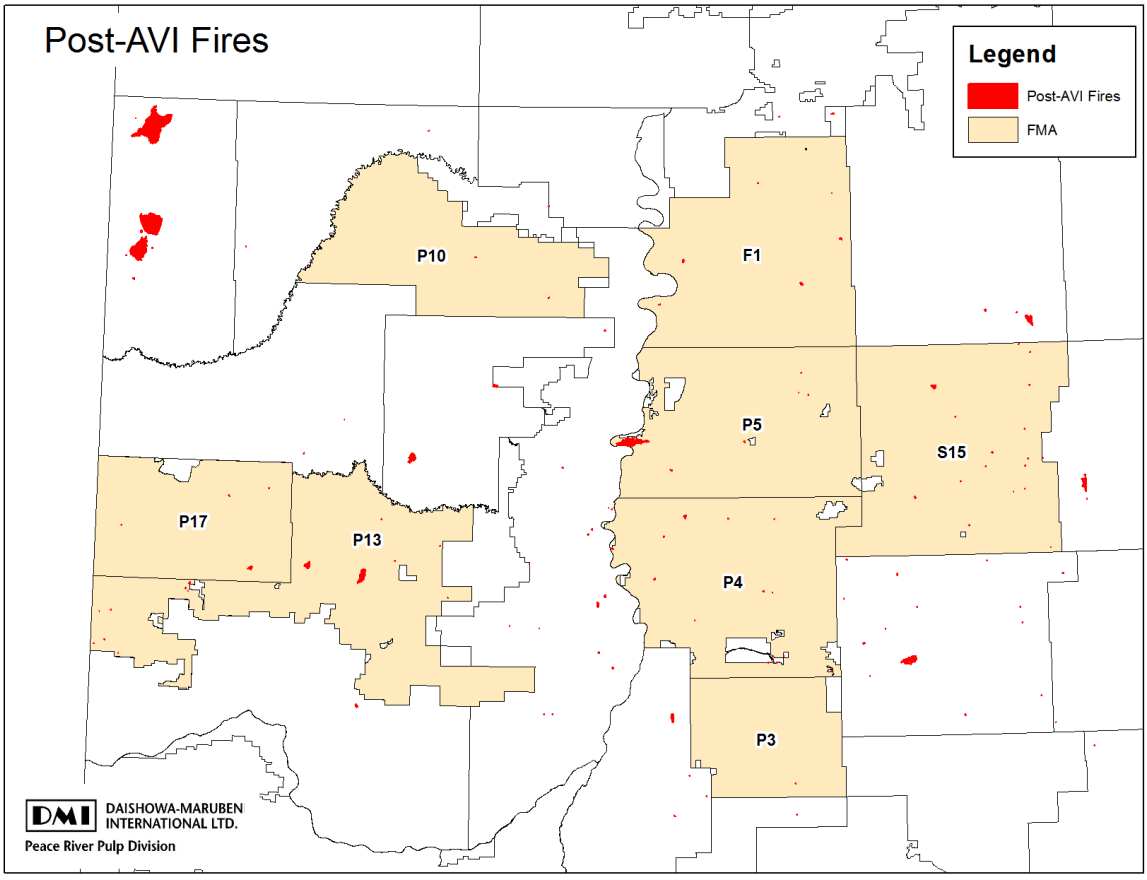
d. Small Permanent - These are all single lined streams (coded AID of 61) and are buffered by 32 metres to allow for an average stream width (actual channel width) of 4 metres.

5.12.1 ATTRIBUTE INFORMATION

Field Name	Data Type	Width	Description
HYDROBUF	String	8	Buffered hydrographic areas Valid values: SWAN – swan nesting sites (200m) LAKE – lakes (100m) LRG_PERM – Double-sided rivers (60m) SM_PERM – Permanent water (32m)

5.13 HISTORICAL WILDFIRES

(Feature class: *post_avi_fires*).These are the historical wildfires that have occurred since the AVI Inventory photography was flown. Fires have been "updated" to remove any overlap between fires. (This was done to remove duplicate area polygons as a result of geo-processing.) Data originated from Sustainable Resource Development with an effective date of October 2010 and a spatial accuracy of +/- 7m. This layer includes all wildfires from 2009 but does not include 2010 wildfires.



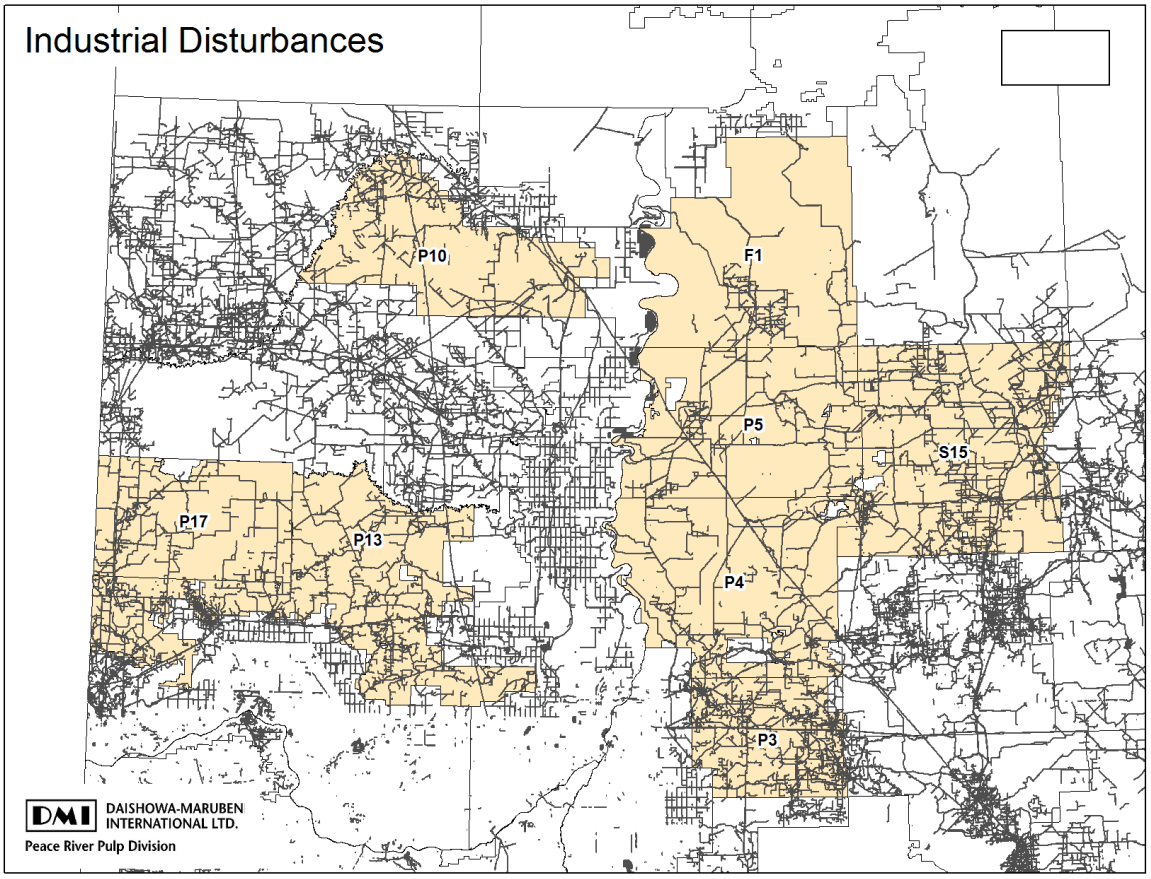
NOTES - Original fire data obtained from the provincial government (Provincial Forest Fire Centre). Fires data (***fireyear***) originally from SDE, has been revised to reflect earliest to latest within the data. This was done to eliminate duplicate area polygons within the data (occurring via geoprocessing) from overlapping fires. Individual years were selected from the source data and using the 'update' process in ArcMap, combined to create the final dataset.

5.13.1 ATTRIBUTE INFORMATION

Field Name	Data Type	Width	Description
FIREYEAR	Small Integer	2	Year of fire
FIRENUMBER	String	12	Unique Fire name (government assigned) in the form AAA-BBB-YYYY AAA – LFS area identifier BBB – 3 digit fire sequence number YYYY – 4 digit year

5.14 INDUSTRIAL LINEAR AND POLYGONAL DISTURBANCES

(Feature class: *landuse*).This data set is composite areas of disturbance caused by roads, oil & gas activity, and other industrial users. Roads information originated with base data purchased form the Provincial Government in 1989 with updates from orthophotos in 2005. Landuse data is from Provincial Government survey plans and LSAS Documentation. Effective date for this data is February 2010 with a spatial accuracy of +/- 7m. Note that areas within private land (feature class: *private*) have been erased from this layer.



NOTES - Precedence is from Industrial sites to railroads. This was done to eliminate overlapping types and a resulting duplication of area.

Roads Layer - This dataset is buffered with a width determined by road type to provide the road "footprint". Road buffers are as follows:

Railroad 20m

Highway 52m

Major Road 20m

Minor Road 12m

Landuse Data - Disposition information was extracted from the DMI corporate dataset to represent the disturbance areas removed from the FMA. It should be noted that in some cases, these are planned features that do not get built. DMI chooses to err on the side of caution and use them to build the strategic impact into TSA calculations. Upon implementing the PFMS, operators will do what is right in the field in correspondence with the actual state of the forest

Roads Disposition type – LOC, FRD, RRD, RDS
Utility Disposition type – EZE, ROE, VCE
Pipeline Disposition type - PLA
Wellsites Disposition type - MSL
Industrial Sites Disposition type – MLL, MLP, REC, SMC, PIL, SML, SGL
Industrial Linear and Polygonal Disturbances

5.14.1 ATTRIBUTE INFORMATION

Name	Data Type	Width	Description
LUCLASS	String	12	Industrial and linear disturbances Valid values: Railroad Highway Major Road - from Provincial roads data Minor Road - from Provincial roads data Road – from disposition information Pipeline – from disposition information Utility – from disposition information Wellsite – from disposition information Industrial - from disposition information

Industrial Linear and Polygonal Disturbances were deleted from the net landbase.

5.14.2 SEISMIC LINES

In order to reduce the amount of composite polygons, we did not use seismic to split polygons, instead the following approach was used:

Seismic lines were buffered by 2.5 meters each side with a total width of 5 meters.

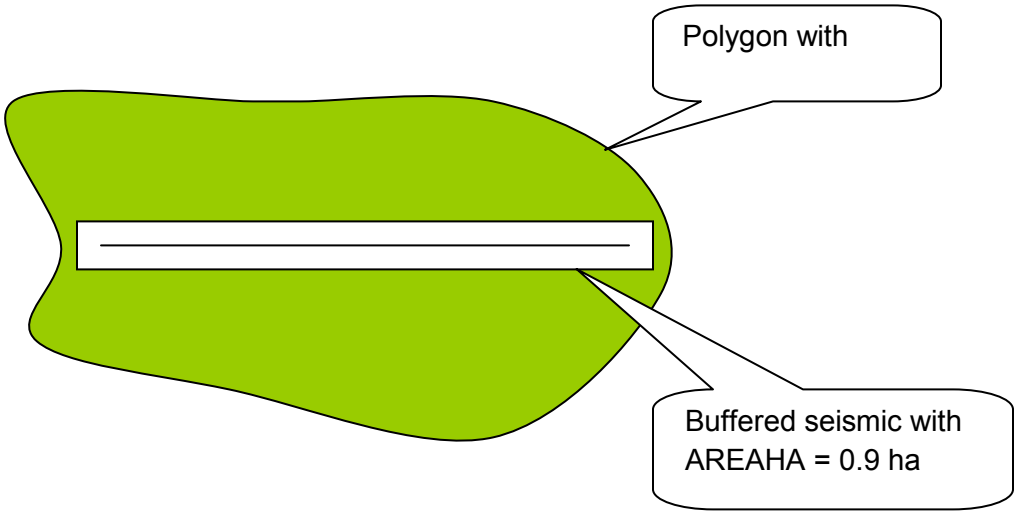
The seismic layer was then overlaid with the forest

The forest area that seismic lines overlap was erased

The TREEDAREAHA (adjusted area) of each polygon was calculated as the total area left

"TREEDAREAHA" is used to calculate the net landbase and will be used for timber supply modeling.

Example:



The adjusted area (TREEDAREAH) used in timber supply modeling for the polygon is:

TREEDAREAH = 8ha – 0.9ha = 7.1ha

Buffered seismic lines are permanent deletions and do not contribute to the net landbase.

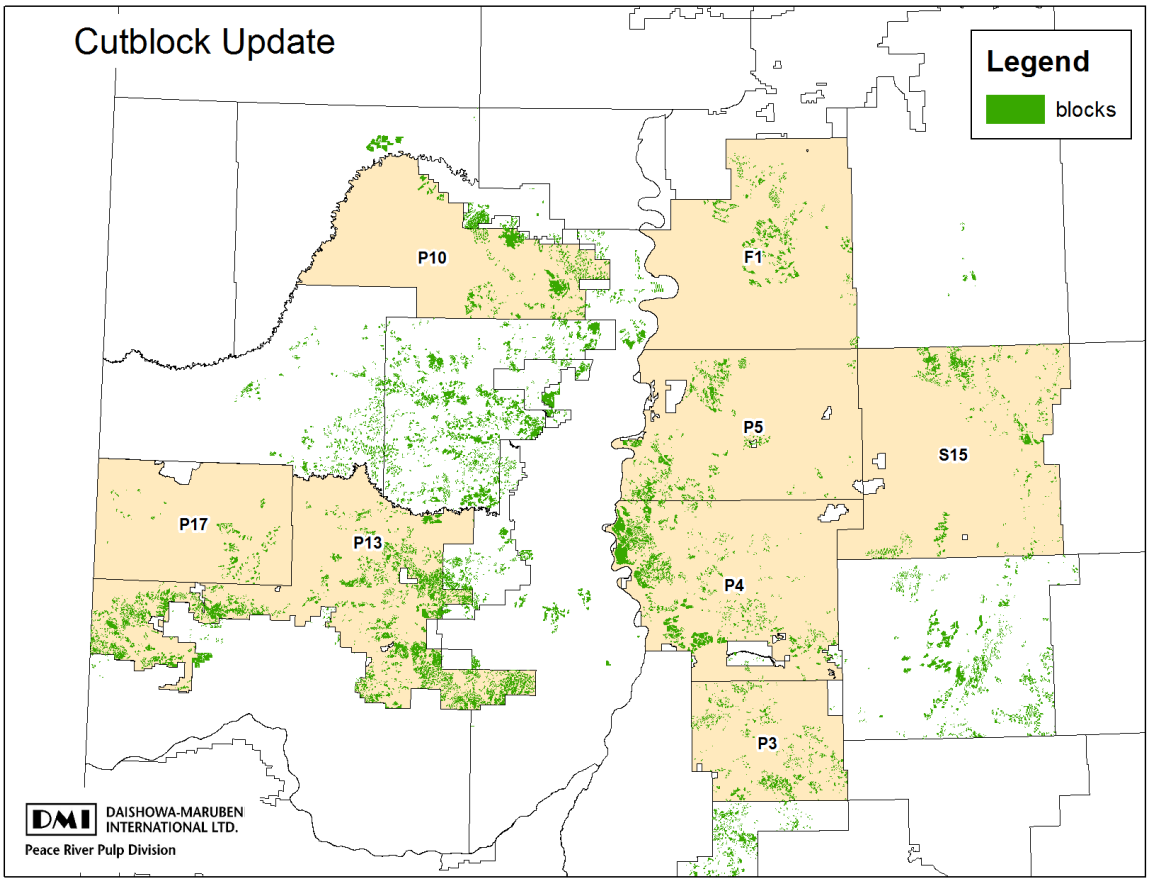
5.15 CUTBLOCK UPDATE

(Feature classes: *blocks* and *blocks_for*). *Blocks* is the historical Cutblock spatial dataset. Cutblocks from the various layers have been "updated" for this process to remove overlaps. DMI retention areas have also been included with this layer and are part of individual blocks. Enhanced block information has been retained in the *Block_details* table and can be joined to

the *blocks* layer on the field BLK_DET_ID. The resulting cutblocks were then intersected with DMI's original forest (1989) to maintain a list of forest information that existed prior to harvest (feature class *blocks_for*). Effective date for this data is April 21, 2011 with a spatial accuracy of +/- 7m.

Cutblocks for all of DMI's tenures are included so that the process presented here may be used within the corporate datasets.

NOTE: The primary entity represented by each unique record is not a cutblock – rather, it is a cutblock fragment. BLK_Class refers to what kind of block fragment that entity is (Cut or Retention or Removal).



5.15.1 ATTRIBUTE INFORMATION

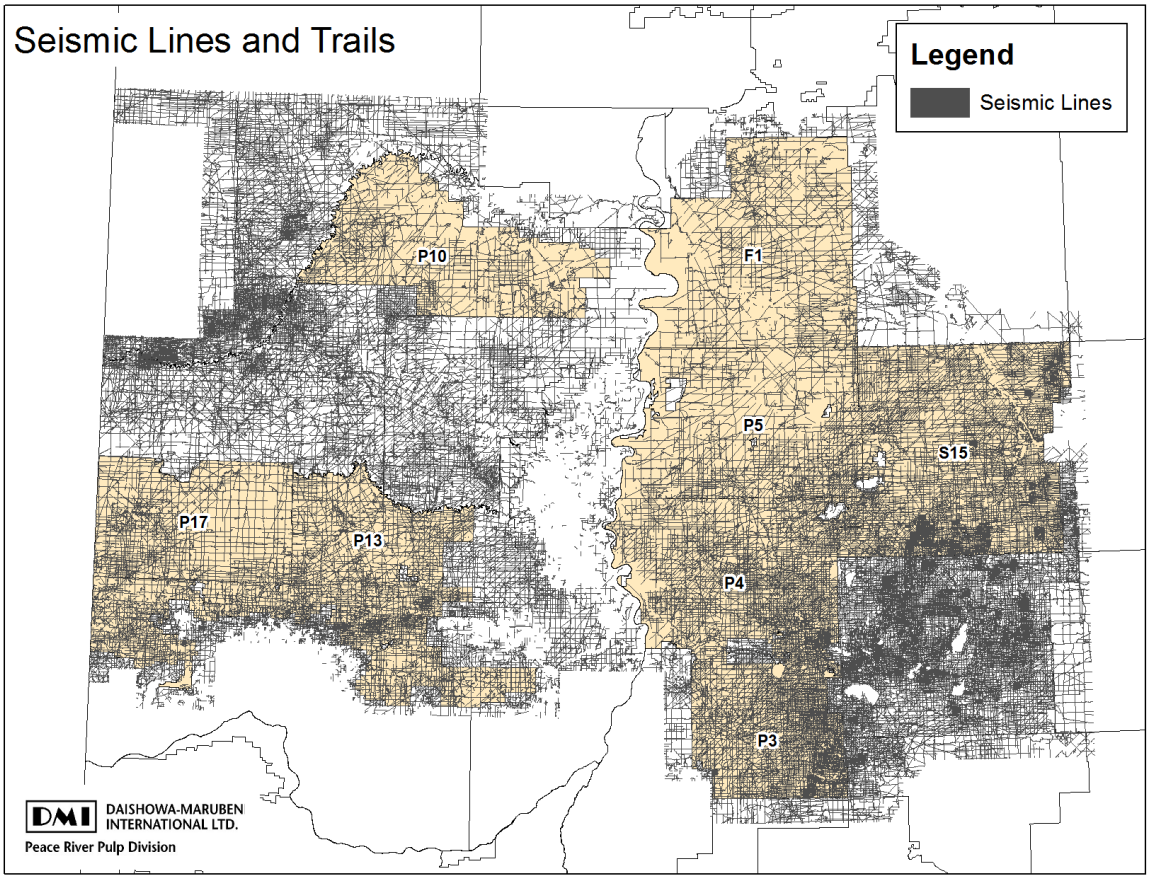
Field Name	Data Type	Width	Description
BLK_DET_ID	Integer	4	Link to detailed blocks information in *Block_details* table
BLK_TYPE_STAT	String	10	Block status Valid values: P – planned U – unplanned
HARV_YEAR	Small Integer	2	Year of harvest
BLK_CLASS	String	10	Block fragment type Valid values: CUT – cut portion of a cut block RET – retention REM – removal
BLK_TYPE	String	25	Reason for Removal, or type of retention Valid values: AVI – DE – Deferred due to density HT – Deferred due to height TS – deferred due to Tree Size FA – deleted due to Flooded GR – deleted due to Grass LU – deleted due to Land Use SH – deleted due to shrub TP – deleted due to Topographic UN – deleted due to Unmerchantable I – Internal retention X – proximal retention US – cut, understory protection
SOURCE	String	15	Source of block data Valid values: AVI_1 – Original AVI AVI_2 – Reinventory Built GPS – GPS boundary GOV – Government Layout ORTHO – Orthophoto PHOTO PLAN – Planned cutblock TOLKO - Tolko UPD – Photo-confirmed boundary
BLOCKS_KEY	Integer	4	Unique identifier of individual block fragments in the blocks layer
BLOCKS_UK	Integer	4	Unique identifier of individual blocks (equal to BLOCKS_KEY)

Attributes for feature class *blocks_for* are identical to those of *blocks*, with two additional fields:

Field Name	Data Type	Width	Description
VI1_POLYID	Integer	4	Link to original AVI information (VI1)
ORIG_FID	Integer	4	FID of corresponding *blocks* feature

5.16 SEISMIC LINES AND TRAILS

(Feature class: *seismic_5m*).These are the seismic lines and trails buffered to a 5.0m width. Original data was purchased in 1989 from the Provincial Government and is partially updated from orthophotos. Effective date is October 2008 with a spatial accuracy of +/- 7m.



Seismic lines were used to calculate the treed portion of polygons (see Sec. 3.14.2).

Field Name	Data Type	Width	Description
ORIG_FID	Integer	4	FID of original seismic feature

5.17 OTHER DATASETS

In addition to the preceding datasets, there are two other datasets that are used in the attribute assignments but not involved directly with the spatial overlays. These data sets are used to assign attributes to the individual polygons but do not split existing or composite forest polygons. The level of accuracy and "fuzzy" boundaries of these datasets are the determining factor for this method. These datasets are as follows:

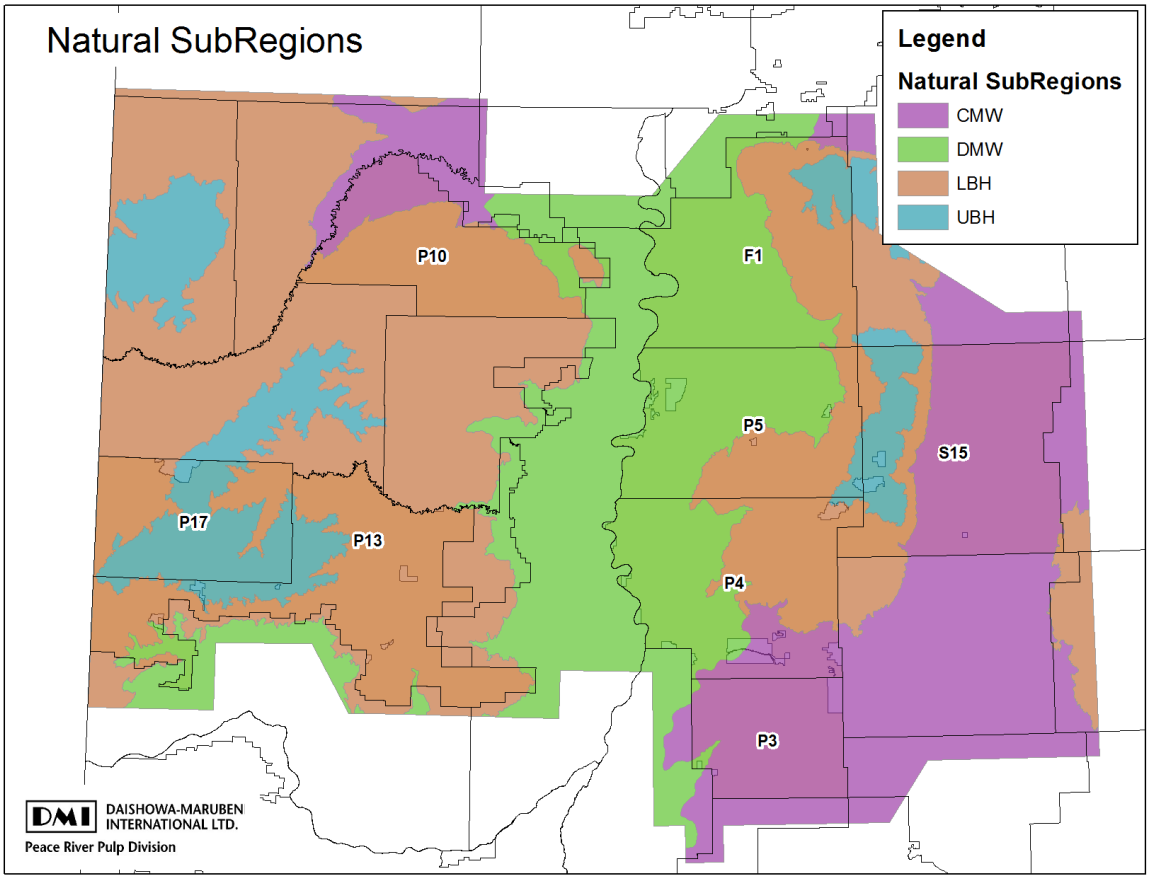
Natural Sub-Regions of Alberta
Gauging Station Catchment Areas

To incorporate these attributes to affected polygons, features have been selected using a point-in-poly selection process in ArcMap. From this, polygons can be assigned attributes without splitting the final output polygon.

5.18 NATURAL SUB-REGIONS OF ALBERTA

(Feature class: *natural*).This is a sub-set of the original Natural Sub-Regions dataset from the Provincial Government. Data originated from Sustainable Resource Development with an effective date of October 2009 and a spatial accuracy of +/- 7m. (Note that the original dataset did not cover the entire FMA, but left a swath 80m wide along the western edge. This has been corrected in the current layer).

Sub regions are added into the composite for supplemental use. They are not used in decision making in the TSA.



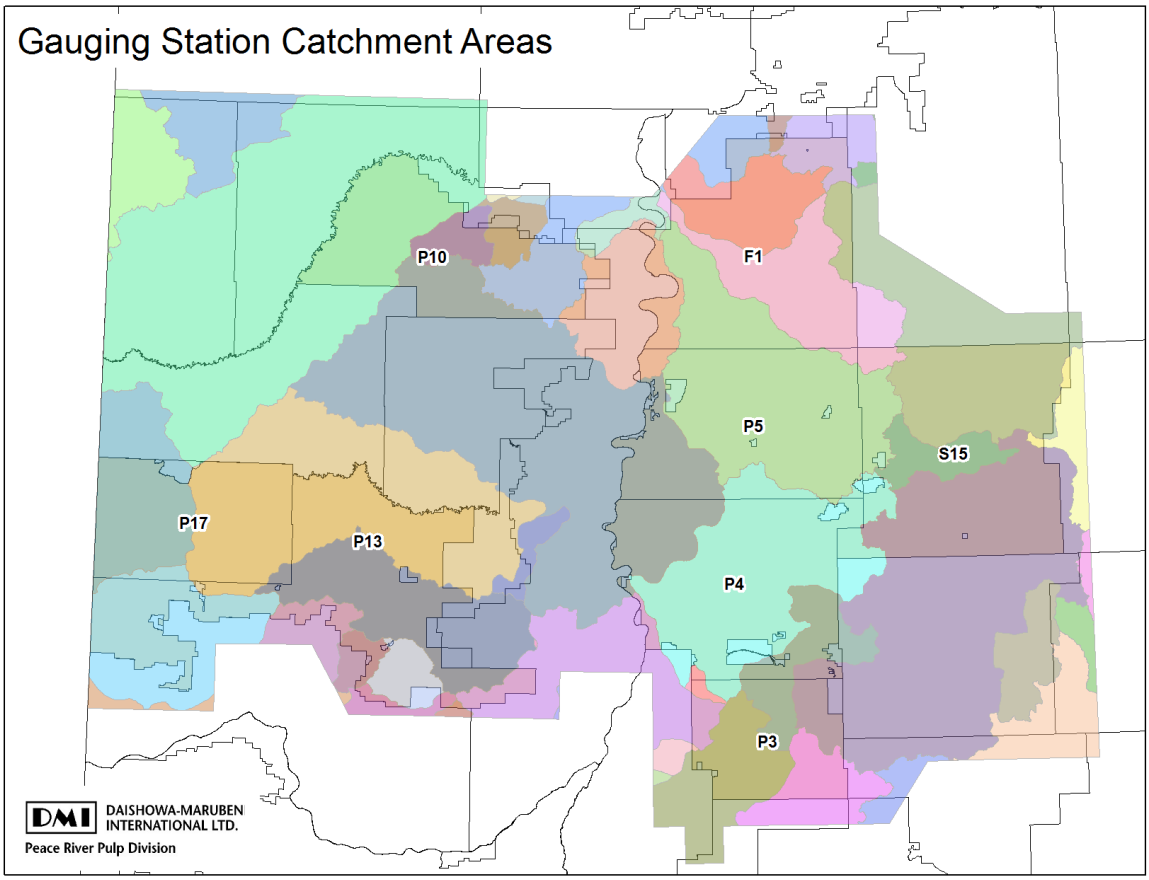
5.18.1 ATTRIBUTE INFORMATION

Field Name	Data Type	Width	Description
NATURAL	String	3	Natural Sub-Regions Identifier Valid Values: CMW – Central Mixedwood DMW – Dry Mixedwood LBH – Lower Boreal Highlands UBH – Upper Boreal Highlands

5.19 GAUGING STATION CATCHMENT AREAS

(Feature class: *catchments*).The Watershed Project is a long-term Prairie Farm Rehabilitation Administration (PFRA) undertaking that has entailed the creation and maintenance of a drainage area database (based on hydrometric gauging stations) for the Canadian Prairies. These catchment areas are for the gauging stations established by the Water Survey of Canada (Environment Canada). They are meant for hydrologic analyses and mapping in watershed management across the Canadian prairies. The version of this data is Version 4. The effective date is February 2004 with no published spatial accuracy.

Every composite polygon is tagged with one of these catchments. This will be used in the TSA.



ATTRIBUTE INFORMATION

Field Name	Data Type	Width	Description
CATCHKEY	Small Integer	3	Link to Gauging Station Catchment dataset

6 COMPOSITE FOREST CREATION

The composite forest is essentially the AVI spatial dataset with many decision making layers intersected into it. On top of the spatial composite representation of the forest, stratifications and information are applied for use in calculating and/or implementing the DFMP. The composite becomes the 'working' forest map for the life of the DFMP.

6.1 COMPOSITE PROCESS

THE COMPOSITE IS CREATED THROUGH A SERIES OF OVERLAYS AND DATA MANIPULATIONS DESCRIBED IN

Figure 6-1. All work is done in ArcMap. The following sections describe that process.

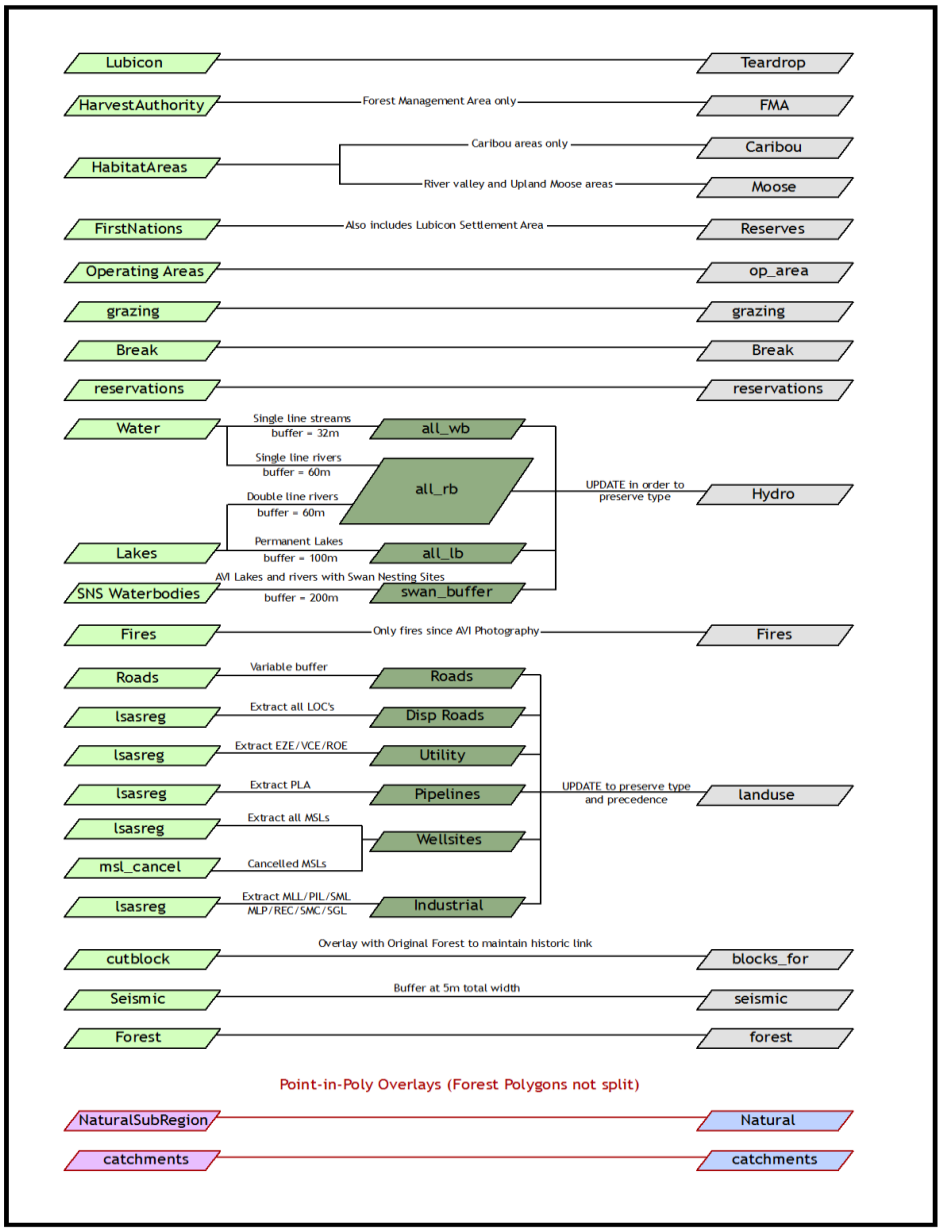


FIGURE 6-1. SPATIAL DATA FLOW DURING CREATION OF THE COMPOSITE FOREST.

The ArcMap Model Builder function was used to produce the composite forest workflow. For performance reasons, it was divided into 4 separate models; one that built a “multi-unioned” dataset of most of the spatial layers and 3 other models that were delineated by spatial extents to provide acceptable processing times. Although the total time to create the final dataset is

longer, by dividing the spatial extent, individual processing time was reduced. Models were converted to Python scripts to reduce processing time. A detailed description of each of the 2 basic models follows.

6.1.1 MULTI-UNION MODEL

The multi-union model was split into two different streams. The complete model flow demonstrated in Figure 6-2 is as follows:

The first seven spatial layers are unioned together.
The second seven spatial layers are unioned together.
These two unioned datasets are then unioned together.
Additional fields that will be populated later in the process are added.
Any fields not required in the final dataset are deleted. This includes any internal fields created in the union process.
Geometry of the dataset is repaired.
The final multi-union dataset is run through the “multipart to single part” process in ArcMap to create one polygon/shape for every record.

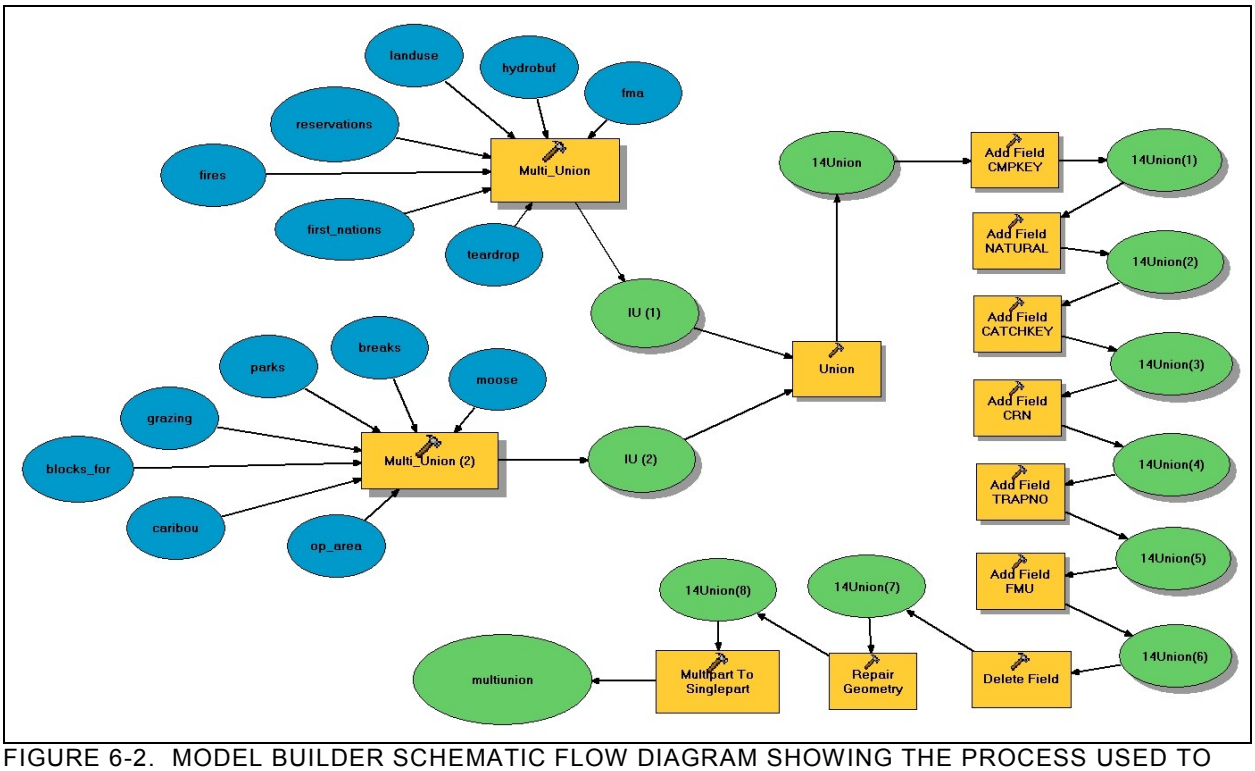


FIGURE 6-2. MODEL BUILDER SCHEMATIC FLOW DIAGRAM SHOWING THE PROCESS USED TO BUILD THE MULTIUNION INTERMEDIATE SPATIAL LAYER DURING THE COMPOSITE FOREST BUILD PROCESS.

6.1.2 COMPOSITE MODEL

The composite model is much more complex than the multiunion and as such, takes much longer to run. For this process, the Forest Management Area has been divided into 3 spatial areas: P10 and P13 which make up the West FMA and the rest of the FMUs that make up the East FMA. The complete composite model flow demonstrated in Figure 6-3 is as follows:

The multi-union dataset is clipped with a buffered dataset of the spatial extent. This is done to reduce the processing time and make sure all polygons within the spatial area are accounted for.
The current AVI dataset is clipped with a buffered dataset of the spatial extent.
These 2 clipped datasets are unioned together.
A linkfield is added for a future table-join. This field is temporary and will be removed later.
Dataset geometry is repaired to fix any issues that may have arisen during the union process.
The dataset is run through the multipart to single-part function.
The linkfield values are calculated.
The field “TREEDAREAHA” field is added. This field will represent the area of each polygon that actually has trees/volume.
The buffered seismic dataset is clipped with the spatial extent
The “unioned forest” dataset from step 7 above is erased with the clipped buffered seismic dataset.
The temporary field “seis_ta” is added and calculated as the area of the shape.

This “erased seismic” dataset is then joined with the “unioned forest” dataset using the linkfield as a join.
From this join, TREEDAREAHA in “unioned forest” is calculated from “seis_ta” / 10000 to get the treed area in each polygon in hectares.
Unnecessary fields are then dropped.
Another multi-part process is done to give an intermediate composite.
This intermediate composite is joined to the attribute table to have access to forest polygon attributes.
Composite polygons are selected by FMU (part of the processing reduction process)
The unique identifier field “CMPKEY” is calculated. This is achieved by adding 1000000 to the OID value for P10, 3000000 to the OID value for P13 and 4000000 to the OID value for the east FMA.
FMU field in the composite is calculated
Unnecessary fields are deleted
As described earlier in the processing issues, a “simplify polygons” process is run on the dataset.
The final dataset is produced.

When creating the West FMA dataset, the two model outputs (P10 & P13/P1N) are merged together to create one dataset.

The final outputs are two composite forests in file-based geodatabase formats. There is one for East FMA and one for West FMA. At the time of this document, they are identical in conceptual design.

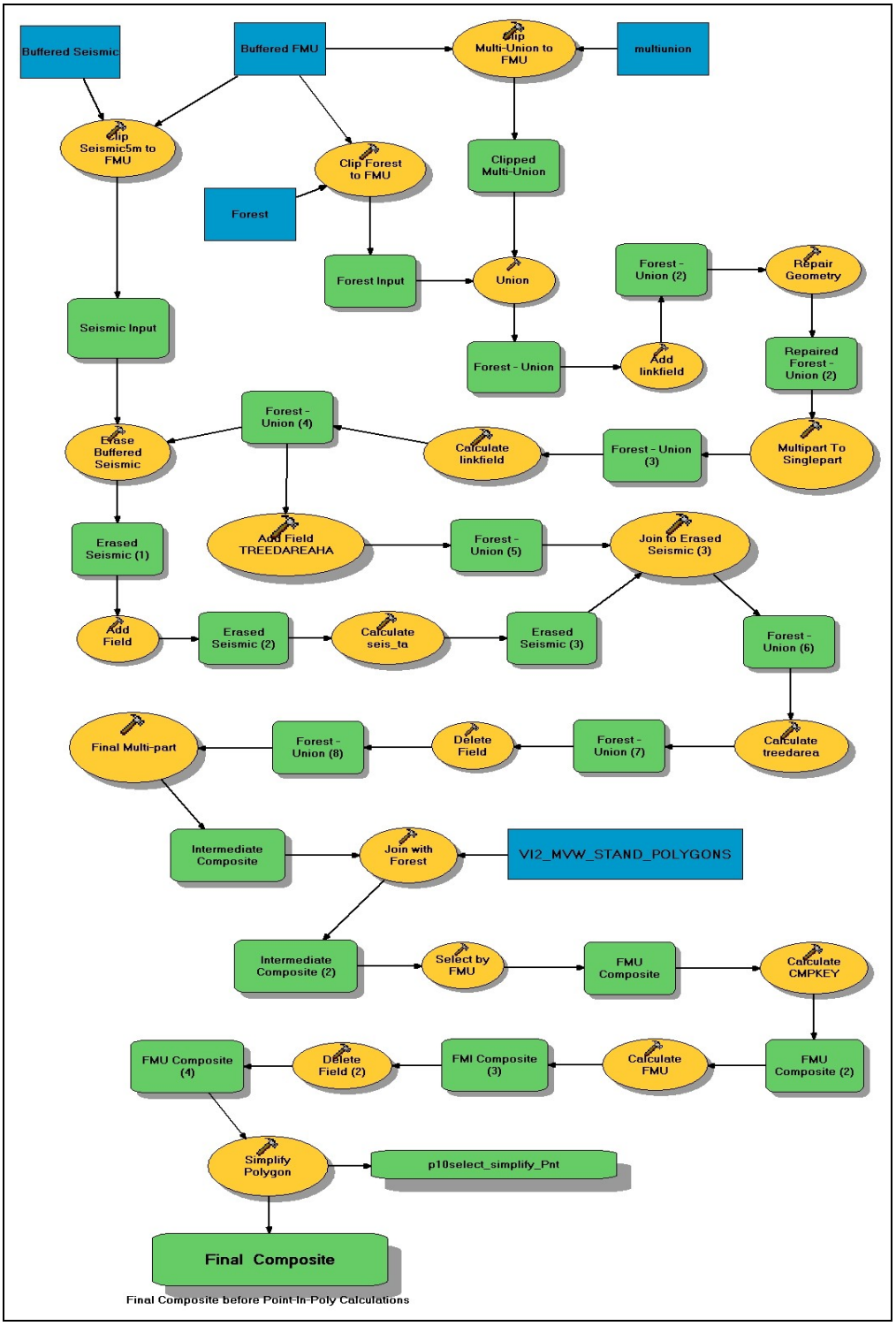


FIGURE 6-3. MODEL BUILDER SCHEMATIC DIAGRAM OF PROCESS FLOW FOR CREATION OF THE COMPOSITE FOREST.

6.2 ATTRIBUTE DEFINITIONS

The following table lists all fields contained within the final composite attribute table including internal fields required by ArcMap. More information on the attributes can also be obtained through the internal metadata.

TABLE 6-1 TABLE DESCRIPTION FOR COMPOSITE FOREST ATTRIBUTE TABLE.

Name	Data Type	Width	Description
OBJECTID	OID	4	Internal feature number
SHAPE	Geometry	0	Feature Geometry
PID	Small Integer	2	AVI Polygon ID
MER	Small Integer	2	Meridian Valid values: 5,6
TWP	Small Integer	2	Township Valid values: 85 - 103
RGE	Small Integer	2	Range Valid values: 1 - 26
POLYID	Double	8	Polygon ID (link to Oracle VI attributes) unique identifier in VI
STANDID	Double	8	Stand ID (link to Oracle VI attributes) INTERNAL DMI USE in VI only
TEARDROP	Small Integer	2	Lubicon area of interest flag Valid values: 0 – no 1 - yes
IRTAG	String	3	First Nations Reserve flag Valid values: LR – Loon River WC – Woodland Cree LUB - Lubicon
HYDROBUF	String	8	Buffered hydrographic areas

Name	Data Type	Width	Description
			Valid values: SWAN – swan nesting sites (200m) LAKE – lakes (100m) LRG_PERM – Double-sided rivers (60m) SM_PERM – Permanent water (32m)
FIREYEAR	Small Integer	2	Year of fire
FIRENUMBER	String	12	Unique Fire name (government assigned) in the form AAA-BBB-YYYY AAA – LFS area identifier BBB – 3 digit fire sequence number YYYY – 4 digit year
LUCLASS	String	12	Industrial and linear disturbances Valid values: Railroad Highway Major Road - from Provincial roads data Minor Road - from Provincial roads data Road – from disposition information Pipeline – from disposition information Utility – from disposition information Wellsite – from disposition information Industrial - from disposition information
RESERVATION	String	10	Research plots and protective notations that have a harvest reservation Valid Values: WESBOGY, TSP1999, TSP2005, PSP1990, PSP2005, PSPGOV, NIVMA, MWMA, EMEND, PNT######, REC######
FMA	Small Integer	2	Forest Management Area

Name	Data Type	Width	Description
			Valid Values: 0 – no 1 - yes
PARK_KEY	Small Integer	2	Link to detailed Parks information
BREAK	Small Integer	2	Breaks flag Valid Values: 0 – not within break 1 – Area within Incised valley – non contribute lbase 2 – Area of rugged terrain – contribute landbase 3 – Area too steep to operate – non contribute landbase
GRAZING	Small Integer	2	Grazing Area flag Valid values: 0 – no 1 - yes
GRAZING_KEY	Small Integer	2	Link to grazing dataset for further information
HARV_YEAR	Small Integer	2	Year of harvest from best known source
BLK_CLASS	String	10	Block class: What portion of a cutblock from the blocks layer is this? Valid values: CUT – cut REM - removal RET – retention
BLK_TYPE	String	25	Reason for deferral Valid Values: AVI – Complete non-merch AVI poly embedded in a block: legacy not used anymore DE – Deferred due to density HT – Deferred due to height TS – deferred due to Tree Size FA – deleted due to Flooded GR – deleted due to Grass LU – deleted due to Land Use SH – deleted due to shrub

Name	Data Type	Width	Description
			TP – deleted due to Topographic UN – deleted due to Unmerchantable I – Internal retention X – proximal retention US – cut, understory protection
BLK_TYPE_STAT	String	10	Valid Values:null P – Planned U - Unplanned
SOURCE	String	10	Source of block data Valid values: AVI_1 – Original AVI Built – GPS layout boundaries amended with operational changes as existed at skid clear date GPS – GPS boundary GOV - Government LAYOUT – GPS boundary from the final layout phase ORTHO – Digitized from orthophoto PHOTO – Digitized from air photo PLAN – Planned cutblock – boundary given to the layout person before going to the field
BLK_DET_ID	Integer	4	Blocks Details ID: Link to detailed blocks information
DISPBLK	String	35	DispositionBlock: Disposition and Block number as used in the approvals for harvest
BLOCKS_KEY	Integer	4	Unique identifier of individual block fragments from the spatial Blocks layer
VI1_POLYID	Integer	4	Unique AVI polygon ID from the original AVI information (VI1) Only present for older blocks.

Name	Data Type	Width	Description
CARIBOU	Small Integer	2	Caribou range flag Valid values: 0 – no 1 - yes
OP_AREA	String	25	Operating Area (DMI)
MOOSE	Small Integer	2	Moose habitat flag Valid values: 0 – no 1 – River Valley Moose zone 2 – Upland Moose zone
CMPKEY	Integer	4	**PRIMARY KEY FOR THE COMPOSITE FOREST**. Unique polygon identifier
NATURAL	String	3	Natural Sub-Regions Identifier Valid Values: CMW – Central Mixedwood DMW – Dry Mixedwood LBH – Lower Boreal Highlands UBH – Upper Boreal Highlands
CATCHKEY	Small Integer	2	Link to Gauging Station Catchment dataset
CRN	Small Integer	2	Continuous Reserve Network: empty. For future internal DMI use
TRAPNO	String	8	Trapline Number: Empty. For future internal DMI use
FMU	String	4	Forest Management Unit
TREEDAREAHA	Double	8	Area of stand not affected by seismic/trails
SHAPE_length	Double	8	Length of feature in internal units
SHAPE_area	Double	8	Area of feature in internal units

7 AVI PROCESSING

7.1 BROAD COVER GROUP DETERMINATION

A broad cover group was assigned to each stand based on the percentage of deciduous crown closure calculated from their AVI cover type (Table 7-1). For single story stands, the calculation of deciduous crown closure is straightforward. For multistory stands the procedure uses a composite weighting scheme based on the relative height and crown closure of the two stand components.

Table 7-1. AVI BCGRP definition.

Broad Cover Group	Deciduous Crown Closure %	Coniferous Crown Closure %
0	0	100
1	10	90
2	20	80
3	30	70
4	40	60
5	50	50
6	60	40
7	70	30
8	80	20
9	90	10
10	100	0

The broad cover group for multi-storied stands was assigned as follows:

If one layer is forested and one layer is not, then the forested layer is used to determine broad cover group.

If one layer has a crown closure of ‘A’ then the layer that was not ‘A’ was used to determine the broad cover group.

If one layer was over 14 m tall and the other layer was less than 14 m tall, and the layers had at least 4 m difference in height, then the taller layer was used to determine the broad cover group.

If both layers were over 14 m tall, or both layers were less than 14 m tall, or if the heights of the layers were within 4 m of each other, then a weighting was assigned to each layer according to the crown closure of each layer as presented in Table 7-2. .

TABLE 7-2. COMPOSITE WEIGHTING SCHEME BY CROWN CLOSURE OF COMPONENT STAND LAYERS.

Crown Closure	Weight
A	18
B	40
C	60
D	85

Weighted intBCGRP = (Overstory deciduous summed percentage * overstory weight + Understory Deciduous summed percentage * Understory weight) / (Understory weight + Overstory weight))

Once the weighted intBCGRP was determined, the stand was assigned to a letter code BCGRP according to Table 7-3. If the broad cover group was 5, the cover group was set to CD if the leading species was coniferous and to DC if the leading species was deciduous.

TABLE 7-3. BROAD COVER GROUP ASSIGNMENT.

Cover Group	Integer Broad Cover Group	Species 1
C	0-2	
CD	3-4	
CD	5	Conifer Species
DC	5	Deciduous Species
DC	6-7	

Cover Group	Integer Broad Cover Group	Species 1
D	8-10	

Landbase (ownership of rights) designation varies by forest management unit. Table 7-4 lists the landbase designations for each stand based on forest management unit and cover group. The historical FMUs are maintained to this day because business arrangements still respect their boundaries. They exist in day-to-day business as valid entities. Maintaining them also allows the TSA to consider scenarios that duplicate past divided landbase scenarios for comparison purposes. The final TSA results will be presented by current FMU designations.

TABLE 7-4. HISTORICAL LANDBASE DEFINITIONS BY FMU AND BROAD COVER GROUP.

Forest Management Unit	Cover Group	Landbase Designation
P2,P5,S15	D,DC	LD
P2,P5,S15	CD,C	LC
P3,P4,F1,P10,P11,P1N, P1S	D	LD
P3,P4,F1,P10,P11,P1N, P1S	DC,CD,C	LC

7.2 AVI COMPILATION

AVI records have been extracted from the VI Oracle dataset and placed in the standard AVI tables for this submission. The supplied database ***avi2_compiler.accdb*** contains the processes for formatting the tables and calculating the processed fields.

TABLE 7-5. LIST OF TABLES IN THE MS-ACCESS FILE *AVI2_COMPILER.MDB*.

Table Name	Table Description	Table Type
OSCOVER	Contains overstory information (TABLE OSTORY) from the AVI that has been copied into this template with minor processing (changed field types on forestkey fields to long and added polyid). March 2, 2011 avi dump	Output
OSTORY	RAW INPUT TABLE FROM DMI ORACLE - OVERSTORY INFORMATION. avi dump march 2, 2011 Changed field types on forestkey fields to long and added polyid	Input

Table Name	Table Description	Table Type
OSTORY_MOD1	RAW AVI INPUT TABLE - OVERSTORY MODIFICATIONS	Input
OSTORY_MOD2	RAW AVI INPUT TABLE - OVERSTORY MODIFICATIONS2	Input
STAND DATA	ostory and ustory are combined with decision rules to make a call on the overall stand. Used for daily production work to ensure consistency with DFMP rules and calculations. March 2, 2011 avi dump	Output
STANDPOLY	Translation table to enable tables to use the newer POLYID key instead of the concatenated forestkey items. avi dump March 2, 2011	Utility
USCOVER	Contains overstory (table USTORY) information from the AVI that has been copied into this template with minor processing (changed field types on forestkey fields to long and added polyid). March 2, 2011 avi dump	Output
USTORY	RAW INPUT TABLE FROM DMI ORACLE - UNDERSTORY INFORMATION. avi dump March 2, 2011	Input

7.2.1 GENERAL PROCESSING STEPS

There are four input tables: Ostory, Ustory, OstoryMod1 andOstory Mod2. Ostory is copied into OSCOVER and calculated fields are processed. Ustory is copied into USCOVER and calculated fields are processed. OSCOVER and USCOVER are used together to determine the overall stand condition and the results are written into the table STAND DATA.

All work is done through action queries. There are 3 initialize queries that delete all records in the working templates OSCOVER, USCOVER, and STAND DATA without deleting the metadata for these tables. Then there are 4 action queries that perform the compilation.

7.3 AVI COMPILE STEPS

7.3.1 DELETE RECORDS FROM OSCOVER

Deletes all records from the OSCOVER template without removing the metadata.

7.3.2 DELETE RECORDS FROM STAND DATA

Deletes all records from the STAND DATA template without removing metadata.

7.3.3 DELETE RECORDS FROM USCOVER

Deletes all records from the USCOVER template without removing metadata.

7.3.4 COMPILE1 MAKE OSCOVER,

Copies OSTORY into the OSCOVER template while calculating several derived fields

RELATES:

The input raw AVI overstory table OSTORY is linked to the utility table STANDPOLY through the forest key fields of Township, Range, Meridian, and polygonID (PID). This relate is a simple lookup into the STANDPOLY table to get the unique POLYID for each forestkey. This enables all subsequent processing to use the POLYID as the unique AVI polygon identifier instead of the older, more cumbersome forestkey fields.

DETAILS:

The OSTORY table contains AVI records for every FMU in which DMI holds timber interests. This query returns only those records falling in FMUs that are in the two FMAs or the Sustained Yield Unit, or the Lubicon traditional area.

POLYID, TWP, RGE, MER, PID, and AREAHA are copied across into the OSCOVER table.

The species 1 through 5 and Percent 1 through 5 are copied across into renamed fields.

The FORESTKEY is calculated as a concatenation of TWP, RGE, MER, PID with the use of the function FKEY(). This is legacy for DMI internal use. It is not used in this submission.

Broad cover group is calculated as an integer (intBCGRP field) with the function OBCGRP().

Broad cover group is calculated as a string 4 character letter code (strBCGRP field).with the function STRSA().

NONFOREST is a calculated field that concatenates the standard AVI items NONFORTYPE, NATNONVEG, ANTHVEG, ANTHNONVEG.

The Species Group field is legacy data used for general forest description. It gives a call of the most common species combinations based on BCGRP. It is not used in any decision making for this DFMP.

The CALC_LBASE field is the calculated land base (ownership of rights) using the function STRLBASE().

All other fields are copied across into fields of the same name.

CODE FUNCTIONS :

All of the function calls are found in the Module COVERTYPE FUNCTIONS.

OBCGRP([S1],[S2],[S3],[S4],[S5],[P1],[P2],[P3],[P4],[P5],"",[CC],[HEIGHT],"",0,"","","","","",0,0,0,0,0),-1)

The function is written to enable both overstory and understorey info to be passed in and it will return a composite stand level BCGRP call. In this step the ustory parameters are blank – we are calculating only the overstory BCGRP. The routine loops through the 5 species calls and sums the totals percentage of deciduous content. This is passed back as an integer number between 0 and 10.

STRSA([S1],[INTBCGRP]),"")

Stands for "string SPECIES ASSOCIATION". The function takes in the integer BCGRP and the first species and returns the letter code BCGRP. It is a simple case statement that applies the standard AVI definitions of BCGRP.

Cover Group	Integer Broad Cover Group	Species 1
C	0-2	
CD	3-4	
CD	5	Conifer Species
DC	5	Deciduous Species
DC	6-7	
D	8-10	

sp_grp([s1],[s2],[s3],[s4],[s5],[p1],[p2],[p3],[p4],[p5])

The 5 species calls are passed into the function to determine species group. If the BCGRP works out to be D, the leading deciduous component is returned. If the BCGRP works out to be C, the leading coniferous component is returned. If the BCGRP works out to be CD, the leading coniferous component is returned concatenated with the leading deciduous species. If the BCGRP works out to be DC, the leading deciduous component is returned concatenated with the leading coniferous species.

STRLBASE([FMU],[STRBCGRP])

FMU and strBCGRP are passed into a simple case statement that applies the landbase (ownership of rights) as outlined in applicable Tenure Documents. BCGRP of D is deciduous landbase in all FMUs. BCGRP of DC is deciduous landbase in P2, P5, S10, and S15. BCGRP of DC in all other FMUs is Conifer landbase. BCGRP of CD and C is conifer landbase in all units.

7.3.5 COMPILE2 MAKE USCOVER

Copies USTORY into the USCOVER template while calculating several derived fields

RELATES:

The Ustory table is linked to the Ostory table through an equal join on the forestkey attributes. This will return all ustory records and those ostory records that match. This is then linked to the utility table STANDPOLY through the forest key fields of Township, Range, Meridian, and polygonID. This relate is a simple lookup into the standpoly table to get the unique POLYID for each forestkey. This enables all subsequent processing to use the POLYID as the unique AVI polygon identifier instead of the older, more cumbersome forestkey fields

DETAILS:

Aside from the relates required, this processing step on ustory is identical to the processing steps on ostory. All of the field manipulations and function calls are the same with ustory data being passed into the functions.

7.3.6 COMPILE3 COMPOSITE FLAG

This query passes some overstory and some understorey information into a function that determines whether the record meets the definition of a composite stand in the composite BCGRP definition. If it does, the routine sets a flag to record that.

RELATES:

The USCOVER table is related to the OSCOVER table through the forestkey attributes. This returns a recordset containing all overstory stands. If there is an understorey, the understorey record values are returned in the recordset. If there is no matched understorey, the understorey values for that overstory record are null.

CODE FUNCTIONS

COMPFLAG(OSCOVER!STRUCTURE,OSCOVER!cc,OSCOVER!HEIGHT,USCOVER!cc,USCOVER!HEIGHT)

COMPFLAG assesses each stand against the decision rules described in section 7.1, which describes the composite weighting scheme. The function returns ‘O’ if the stand is to be called on the overstory, ‘U’ if the stand is to be called on the understorey, or ‘C’ if the stand is to be

called on a composite of over and understorey values. The returned value is written into the compflag field.

7.3.7 COMPILE4 MAKE STAND DATA

This query writes the AVI data fields and calculated fields into the STAND DATA table. Each record in STAND DATA represents the stand level call. Decisions made in the composite weighting scheme are incorporated based on the compflag calculated in the previous step.

If the record is to be modeled based on the understorey, then all applicable AVI and calculated fields in the stand data table are assigned the values from the understorey. If the record is to be modeled on the overstory, then all applicable AVI and calculated fields in the stand data table are assigned the values from the overstory. If the record is to be modeled on a composite weighting, then applicable calculated fields are populated by passing oscover & uscover attributes into the functions for processing.

7.4 TABLE DEFINITIONS

TABLE 7-6. TABLE DEFINITIONS FOR ALL TABLES USED IN THE AVI PROCESSING STEP.

Table Name	Field Name	Data Type	Field Description
OSCOVER	POLYID	Long	Unique standpoly id (smallest avi entity) in the ORACLE master database storing the AVI
	TWP	Long	Township
	RGE	Long	Range
	MER	Long	Meridian
	PID	Long	Polygon Identifier
	FORESTKEY	Text	Concatenated forestkey
	FMU	Text	Forest Management Unit
	MOISTURE	Text	Moisture Regime 'd' , 'a', 'w', 'm'
	CC	Text	Overstorey Crown Closure - 25% classes A, B, C, D
	HEIGHT	Long	1metre height class
	S1	Text	Species 1

Table Name	Field Name	Data Type	Field Description
	P1	Long	Percentage Crown Closure of Species 1 - 10% classes
	S2	Text	Species 2
	P2	Long	Percentage Crown Closure of Species 2 - 10% classes
	S3	Text	Species 3
	P3	Long	Percentage Crown Closure of Species 3 - 10% classes
	S4	Text	Species 4
	P4	Long	Percentage Crown Closure of Species 4 - 10% classes
	S5	Text	Species 5
	P5	Long	Percentage Crown Closure of Species 5 - 10% classes
	STRUCTURE	Text	Stand Structure Flag - M=multistory
	ORIGIN	Long	10 year Origin class
	TPR	Text	Timber Productivity Rating - U, F, M, G
	INTERTPR	Text	Interpreted TPR Flag
	NONFORTYPE	Text	Non-Forest Type - BR, HF, HG, SC, SO
	NONFORCL	Long	Non-Forest Shrub Closure - 10% Crown Closure Classes for SO & SC Nonfortypes
	ANTHVEG	Text	Anthropogenic Vegetated - A=Annual Crops; P=Perennial Crops; IP=Industrial Pipeline; IW=Wellsite; IU= Unknown Clearing
	ANTHNONVEG	Text	Anthropogenic Non Vegetated -IF, IG, IH, II, IW, SA, SR
	NATNONVEG	Text	Natural Non-Vegetated - MB, MC, MR, MS, WF, WL, WR
	intBCGRP	Long	Integer Broad Cover Group : 10% Crown Closure Class of Deciduous Species
	strBCGRP	Text	String Broad Cover Group - C, CD, DC, D
	AREAHA	Double	Area in Hectares from .PAT

Table Name	Field Name	Data Type	Field Description
	compflag	Text	Composite Flag - used in composite weighting scheme
	DELETION	Text	Deletion Flag
	NONFOREST	Text	NonForest Class - Concatenation of NONFORTYPE, ANTHVEG, ANTHNONVEG, NATNONVEG
	species group	Text	A Coarse Level classification of leading species
	REFYEAR	Long	Reference Year
	RETYEAR	Long	Retired Year
	RIS LBASE	Text	Landbase derived from composite weighting BCGRP - RIS codes
	LBASE	Text	Landbase derived from Over Storey only
OSTORY	All Fields		This is an autogenerated input file and as such it has no metadata. Look at OSCOVER for field description.
USTORY	All Fields		This is an autogenerated input file and as such it has no metadata. Look at USCOVER for field description.
STAND DATA	POLYID	Long	Unique standpoly id (smallest avi entity) in the ORACLE master database storing the AVI
	TWP	Long	Township 82-103
	RGE	Long	Range 1-26
	MER	Long	Meridian 5-6
	PID	Long	Polygon Identifier: unique to an interpreted polygon within a township, from 1 to 9999
	FMU	Text	Forest Management Unit - f1,p1N, P1S,p2,p3,p4,p5,p10, P11,s15
	compflag	Text	composite weighting of the overstory and understory
	intBCGRP	Long	Integer Code for overstory Broad Cover Group
	strBCGRP	Text	Character Code for overstory Broad Cover Group

Table Name	Field Name	Data Type	Field Description
	intBCGRP_C	Long	Integer Code for Composite Broad Cover Group
	strBCGRP_C	Text	Character Code for Composite Broad Cover Group
	LEADSP	Text	Leading species - single most prevalent species percent
	HEIGHT	Long	Height in 1 m classes
	HT6M	Integer	Height in 6 m classes
	DENSITY	Text	Density Class A,B,C,D
	ORIGIN	Long	10 year origin class
	TPR	Text	Timber Productivity Rating U,F,G,M
	P3STRATA	Integer	OLD Phase3 strata
	SRC96STRATA	Integer	S/RC Yield Curve Strata
	ris89 stratum	Long	RIS department strata
	ris89 stratkey	Text	RIS department strata unique key
	RIS LBASE	Text	RIS Calculated Landbase
	OS_LBASE	Text	Overstory Landbase
	US_LBASE	Text	Understory Landbase
	CALC LBASE_O	Text	Calculated Landbase from overstory Broad Cover Group
	CALC LBASE	Text	Calculated Landbase from Composite Broad Cover Group
	DELETION	Text	Deletion Type
	NONFOREST	Text	Nonforest AVI Code
	species group	Text	Species Group: major species categories used for exploratory work
	COUNTER	Long	Used for Exploratory Work
	AREAHA	Double	Area (ha) of polygon

Table Name	Field Name	Data Type	Field Description
STANDPOLY	PID	Long	Polygon Identifier: unique to an interpreted polygon within a township, from 1 to 9999
	MER	Long	Meridian 5-6
	TWP	Long	Township 82-103
	RGE	Long	Range 1-26
	POLYID	Double	Unique standpoly id (smallest avi entity) in the ORACLE master database storing the AVI
	STANDID	Double	IGNORE - internal stand id not used anymore
	AREAHA	Double	Area (ha) of polygon
	REPLACED_BY_PID	Long	Replaced by - VI internal
	RETYEAR	Long	Retirement Year
USCOVER	POLYID	Long	Unique standpoly id (smallest avi entity) in the ORACLE master database storing the AVI
	TWP	Long	Township
	RGE	Long	Range
	MER	Long	Meridian
	PID	Long	Polygon Identifier
	FORESTKEY	Text	Concatenated forestkey
	FMU	Text	Forest Management Unit
	MOISTURE	Text	Moisture Regime 'd' , 'a', 'w', 'm'
	CC	Text	Overstorey Crown Closure - 25% classes A, B, C, D
	HEIGHT	Long	1metre height class
	S1	Text	Species 1
	P1	Long	Percentage Crown Closure of Species 1 - 10% classes

Table Name	Field Name	Data Type	Field Description
	S2	Text	Species 2
	P2	Long	Percentage Crown Closure of Species 2 - 10% classes
	S3	Text	Species 3
	P3	Long	Percentage Crown Closure of Species 3 - 10% classes
	S4	Text	Species 4
	P4	Long	Percentage Crown Closure of Species 4 - 10% classes
	S5	Text	Species 5
	P5	Long	Percentage Crown Closure of Species 5 - 10% classes
	STRUCTURE	Text	Stand Structure Flag - M=multistory
	ORIGIN	Long	10 year Origin class
	TPR	Text	Timber Productivity Rating - U, F, M, G
	INTERTPR	Text	Interpreted TPR Flag
	NONFORTYPE	Text	Non-Forest Type - BR, HF, HG, SC, SO
	NONFORCL	Long	Non-Forest Shrub Closure - 10% Crown Closure Classes for SO & SC Nonfortypes
	ANTHVEG	Text	Anthropogenic Vegetated - A=Annual Crops; P=Perennial Crops; IP=Industrial Pipeline; IW=Wellsite; IU= Unknown Clearing
	ANTHNONVEG	Text	Anthropogenic Non Vegetated -IF, IG, IH, II, IW, SA, SR
	NATNONVEG	Text	Natural Non-Vegetated - MB, MC, MR, MS, WF, WL, WR
	intBCGRP	Long	Integer Broad Cover Group : 10% Crown Closure Class of Deciduous Species
	strBCGRP	Text	String Broad Cover Group - C, CD, DC, D
	AREAHA	Double	Area in Hectares from .PAT
	DELETION	Text	Deletion Flag

Table Name	Field Name	Data Type	Field Description
	NONFOREST	Text	NonForest Class - Concatenation of NONFORTYPE, ANTHVEG, ANTHNONVEG, NATNONVEG
	species group	Text	A Coarse Level classification of leading species
	REFYEAR	Long	Reference Year
	RETYEAR	Long	Retired Year
	RIS LBASE	Text	Landbase derived from composite weighting BCGRP - RIS CODES
	LBASE	Text	Landbase derived only from ustory records

8 CLASSIFICATION OF CUTBLOCKS AND FIRE

8.1 GENERAL DESCRIPTION

For each cutblock or fire the best information available was utilized for the stratification. The following types of stratification were used:

8.1.1 PERFORMANCE SURVEY

The following cutblocks were stratified based on their regeneration stratum as defined in the ARIS:

Cutblocks that were harvested post March 1, 1991 with a declared stratum and that have received a performance survey

8.1.2 ESTABLISHMENT SURVEY

The following cutblocks were stratified based on their regeneration stratum as defined in the ARIS:

Cutblocks that were harvested post March 1, 1991 with a declared stratum and that have received an establishment survey

8.1.3 STRATUM DECLARATION

The following cutblocks were stratified based on their regeneration stratum as defined in ARIS:

Cutblocks that were harvested post March 1, 1991 with a declared stratum, but have not received an initial establishment survey.

8.1.4 AVI STRATIFICATION

The following cutblocks were stratified based on the current AVI stratum:

Cutblocks that were harvested prior to March 1, 1991

Cutblocks that were harvested post March 1, 1991 without a declared stratum.

Cutblocks without cut season

large retention patches greater than or equal to 2 hectares

Areas burned pre AVI

AVI polygons with “CC” modifier that are missing on the cutblock layer

8.1.5 STRATIFICATION PREHARVEST

On the Westside (FMUs P13, P10 and P1N), all blocks planned to be harvested in 2008 were stratified based on their current AVI stratum.

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8.1.6 PLANNED LANDBASE

On the Westside (FMUs P13, P10 and P1N), all blocks planned to be harvested in 2009 or after (prescheduled blocks) were stratified based on their current AVI stratum.

8.1.7 CTP RESIDUAL

For the cut disposition “CTP_RESID”, the AVI stratum 3 (Aspen – late Mixed White Spruce) was assigned.

8.1.8 BURN RESPONSE

For fires burnt post AVI, fires were stratified based on their burn response, i.e. the transition from a defined yield stratum before the fire to no strata after the fire. If the burned area was cut and has ARIS records, it is stratified based on the regeneration stratum as defined in ARIS.

8.2 TYPES OF CUTBLOCKS AND FIRE

Depending on the cut season or fire year, whether it was harvested before or after AVI, determines what stratification type was used to stratify a cutblock or a burn. The following types of cutblocks and fire were identified:

1 (Cutblocks that were harvested prior to March 1, 1991)
2 (Cutblocks that were harvested post March 1, 1991 with a performance survey)
3 (Cutblocks that were harvested post March 1, 1991 with an establishment survey)
4 (Cutblocks that were harvested post March 1, 1991 with a declared stratum, but have not received an initial establishment regeneration survey)
5 (Cutblocks that were harvested post March 1, 1991 without a declared stratum)
6 (Cutblocks planned to be harvested prior to the 2009 or 2010 DFMP)
7 (Cutblocks planned to be harvested post 2009 or 2010 DFMP)
8 (Cutblocks without cut season)

9 (Burns pre AVI)
10 (Burns post AVI)
11 (Burns post AVI with cut)
12 (Cuts post AVI with burn)
13 (AVI polygons with “CC” modifier that are missing on the cutblock layer)

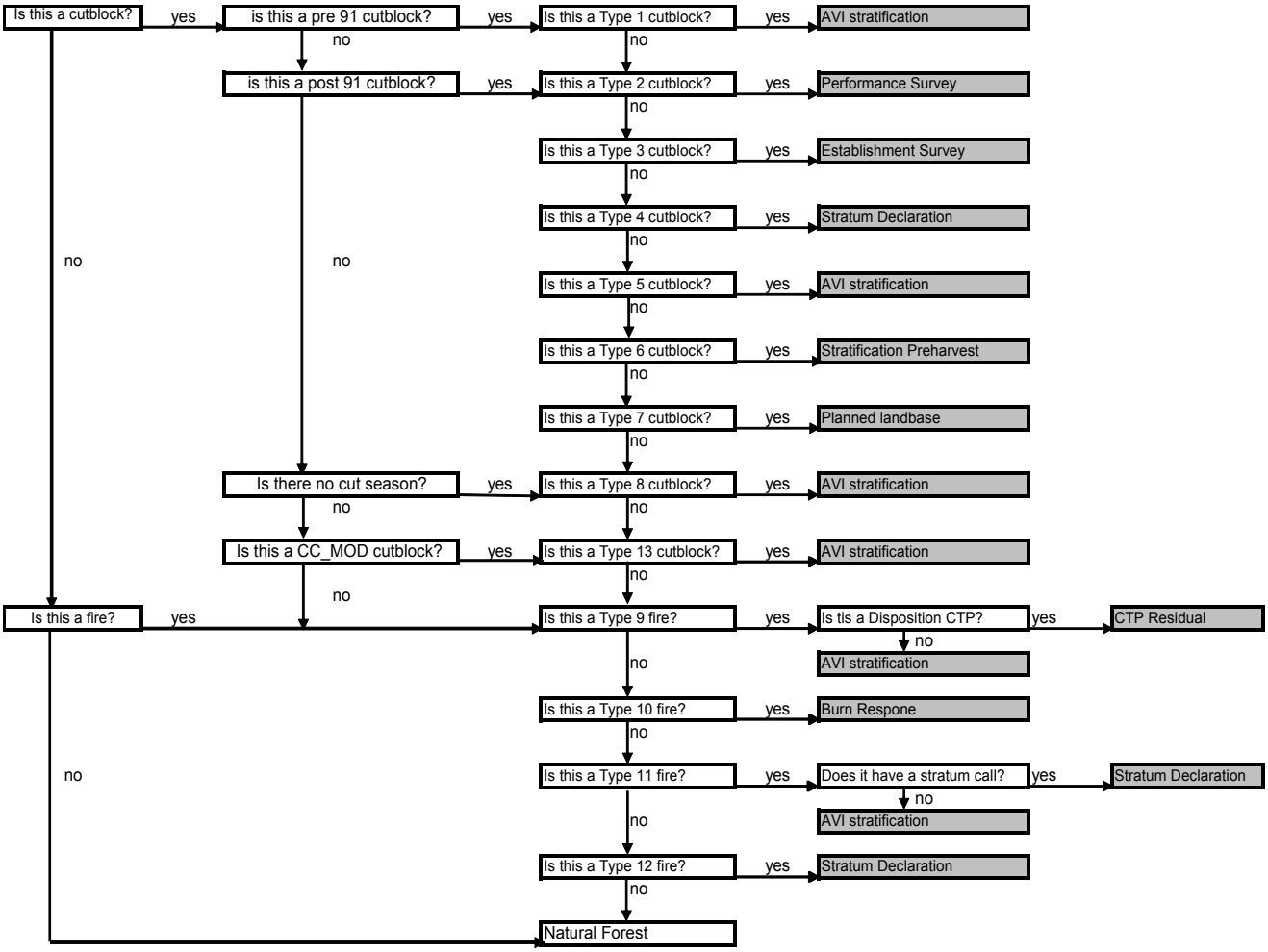


Figure 8-1 Flowchart showing stratification decision criteria for cutblocks and fires

9 CUTOVER PROCESSING

Cutovers are stored separate from AVI in the corporate dataset. All required information for this DFMP process was pulled and processed separate from the corporate datasets. The following sections describe the process used and products produced.

9.1 CREATION OF BLOCKS LAYER

Cutovers in the final TSA products are derived from the following sources:

1989 AVI modifier identified old cuts
Historical spatial records from photo update
GPS layout spatial records
Spatial Harvest sequence aspatial records
Quota Holder Paper maps and aspatial ARIS summaries

DMI compiled spatial representations of all known blocks into the geodatabase layer *Blocks*. This was a manual, interactive process driven largely by local knowledge. Overlaps were eliminated and newer, more spatially accurate representations of blocks replaced older versions. The result is one layer containing all known blocks for all FMUs in which DMI holds timber interests. This is complete with photo update up to the end of the 2009 timber year and all known 2010 and 2011 planned blocks in GPS layout.

9.2 CREATION OF BLOCKS_DETAILS_TABLE

The cutover attributes were compiled as the spatial *Blocks* layer was being built. Quota holders provided historic cutover information in widely variable formats and levels of completeness. DMI completed a reconciliation process that attempted to match each spatial block polygon with clean and complete attributes including ARIS items. This proved exceedingly difficult, particularly with older blocks.

The reconciliation was a manual, interactive process. Harvest dates and operators were tied to spatial blocks using best, newest information. Local knowledge of historical operations was used many times to fill in information gaps. A common problem was that many blocks are represented by a single ARIS opening. At times, the information about the individual block conflicted with the ARIS information about the larger opening.

The final result is the *BLK_DETAILS* Table. This table represents the final decisions on what the appropriate items values will be for all known blocks. It must be noted that there are fewer *BLK_DETAILS* records than there are blocks. Many blocks may point to one details record for its assigned information.

9.3 GENERAL PROCESS

The Block stratification process is contained in the MS-Access file **cutover stratification july2011.accdb**. Table 9-1 lists the tables used in the process.

The general steps in the process are:

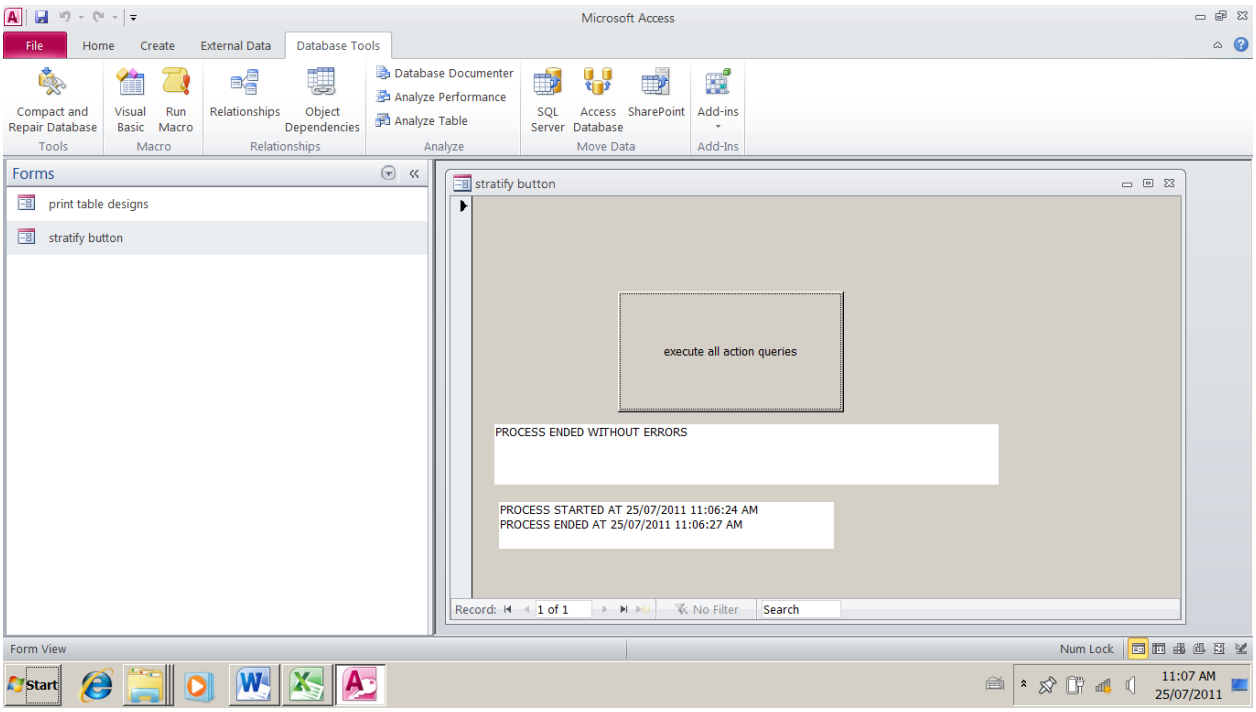
Clean out working 'scratch pad' tables.
Load input information that will be carried through to output files.
Calculate / make decisions / assign stratifications to the working files in a stepwise fashion through action queries. **No input data gets changed**. Duplicates are created in the working space if values are to be changed/overwritten.
Copy final assigned values to output template.

The MS-Access files are shipped and archived in an 'empty state' to save space. The inputs and processes are all present – one must run the process to populate the tables. There are two ways to do this:

One may invoke each action query in the sequence by double clicking it. Follow the naming convention carefully. Do Initialize 01 through 05 and then Step01 through Step 26. Do each action query in its correct order and be careful not to miss any steps.

Note: MS-Access has a 2 gigabyte upper size limitation. It is safest to compact and repair the database after each Initialize sequence to keep the accdb file from exceeding size limits. If the size limit is exceeded, the file will be corrupted and be non-recoverable.

An alternative method provided is to manually run the Initialize sequence queries, run the compact and repair, and then open the form called '***stratify button'***. Click the button and all action queries will run as a batch. When complete your screen will show the following:



All work tables and final outputs are now populated.

TABLE 9-1. LIST OF TABLES FOUND IN MS-ACCESS FILE **CUTOVER STRATIFICATION JULY2011.MDB**.

Table Name	Table Description	Table Type
BLOCKS FMU LOOKUP		Utility
DECLARED STRATA	Lookup table that assigns a model pathway based on ARIS regeneration declaration	Utility
inBLK_DETAILS	Block Details February 9, 2011. Aspatial Block Details Records - ARIS information for all blocks	Input
inBLOCKS	Spatial Blocks Layer Attributes Feb 9, 2011	Input
inCOMPFOREAST	Composite Forest attributes for FMA east Feb. 15, 2011	Input
inCOMPFORSYU	Composite Forest attributes for SYU Feb. 15, 2011	Input
inCOMPFORWEST	Composite Forest Attributes for Composite Forest West Feb. 15, 2011	Input
outCUTOVER SUMMARY	Duplicate structure of table CUTOVER SUMMARY. Used as the 'scratch pad' for calculation steps - allows automation of entire stratification process.	Output
Qry_list	Query list used to automate the stratification steps	Utility
temp COMPFOR	Template COMPOSITE FOREST : Contains all the spatial information from the creation of the composite forest coverage. THIS IS THE SPATIAL PRODUCT UPON WHICH ALL MODELING IS BUILT	Workspace
util NON MERCH LOOKUP	Utility table - translates GPS data dictionary values into appropriate categories during stratification	Utility
work_temp	Duplicate structure of table CUTOVER SUMMARY. Used a s the 'scratch pad' for calculation steps - allows automation of entire stratification process.	Workspace

9.4 INITIALIZE WORKSPACE

There are 5 initialize action queries. These delete all records from the working tables and load the input into the working tables ready for calculations and stratifications.

9.4.1 INITIALIZE01 CLEAN WORK_TEMP TEMPLATE

General Description: Delete all records from the work_temp table. Leaves a blank template without deleting documentation

9.4.2 INITIALIZE02 CLEAN TEMPLATE CUTOVER SUMMARY

General Description:

Deletes all records from the cutover summary table. Leaves a blank template without deleting documentation.

9.4.3 INITIALIZE03 DELETE RECORDS FROM TEMP COMPFOR

General Description:

Deletes all records from the temp COMPFOR table. Leaves a blank template without deleting documentation

9.4.4 INITIALIZE04 APPEND WEST TO TEMP COMPFOR

General Description:

Appends required fields from east composite forest to the working table temp compfor.

Details:

The following fields are appended because they are required in the process or the final outputs:

CMPKEY; POLYID; BLOCKS_KEY; FMU; TREEDAREAHA; SHAPE_AREA

The dBASE format used in shapefiles truncates field names. This step of copying fields from the input fields to a documented template, allows us to build this as a repeatable process without having to write documentation every time:

Treedareah is copied into Treedareaha
The rest of the fields are copied into fields of the same name

9.4.5 INITIALIZE05 MAKE BLOCKS FMU LOOKUP

General Description:

Makes a table (BLOCKS FMU LOOKUP) that is required in the process. A series of six prequeries are performed to force the process into acting on the recordset in a desired order.

Details:

PREQUERY1: Pulls a recordset from the composite that only contains polygons within cutblocks.

PREQUERY2: Uses prequery1 to build a unique list of block_ids by FMU.

PREQUERY3 Uses prequery2 to pull a list of block_ids for blocks that have more than one FMU

PREQUERY4: For each block in the prequery3 list, return each FMU for which a part of this block falls on and the area intersected with each FMU.

PREQUERY5: Return a list of blocks falling on more than one FMU and return the single largest intersected FMU area.

PREQUERY6: Take results from Prequery5 and look back to find the FMU for which this largest area came from. Return a list of block_ids with the FMU for which most of the block falls. Thus we have assigned the FMU from the single largest FMU chunk for those blocks that straddle FMU lines. Each block is now identified as falling only into one single FMU.

MAKE BLOCKS FMU LOOKUP:

Takes every polygon from the composite that is a block fragment.
If a polygon is in the list of ones with duplicate FMUs, then it is assigned the FMU determined in Prequery6. If it is not in the list of duplicates, then it is assigned the FMU from the composite.
Blocks_Key and FMU for each polygon in composite are written to a new table BLOCKS FMU LOOKUP.

9.5 STRATIFY CUTOVERS

9.5.1 STEP01 APPEND CUT INFO TO WORK_TEMP

General Description:

For all polygons in the blocks layer:
Copies block information from the blocks spatial attribute table and the blk_details aspatial compiled information to the work space table.
Copies the assigned fmu to the work space table.

Relates:

Blocks_UK (stands for unique key) is a legacy corporate dataset moniker that cannot be changed at this time. It is now equal to Blocks_Key in all new work.

9.5.2 STEP02 SET CALCULATED FLAGS TO 0

General Description:

The stepwise stratification uses flags extensively to simplify queries and to carry forward intermediate steps for future use. The flags serve as useful shortcuts in future queries and to ensure consistency.

This step sets all flags in the work space to 0:

cPOST08;cPRE91; cPOST91; cARISLINK; cCUT_TYPE; cARIS_AGE FLAG; charvest YEAR FLAG; Cavi AGE FLAG; ASSIGNED YC; ASSIGNED AGE(YEARS); ASSIGNED TREATMENT; ASSIGNED TREATMENT YEAR;

The field COUNTER is set to a value of 1. This is an internal DMI use field used for troubleshooting and in future summary queries.

9.5.3 STEP03 UPDATE CARIS_LINK FLAG

General Description:

For every record in the work space where there is an ARIS opening present ([OPEN_NUM] not null) and there is an ARIS harvest year present ([HARV_YEAR >0):
Set the [cARIS_LINK] (calculated ARIS flag) field to equal 1.

9.5.4 STEP04 UPDATE cPRE91 FLAG

General Description:

For every record in the work space where (the skid year is less than 1991 ([SKID_YEAR <1991)) OR (the skid year is null AND the harvest year is less than 1991 ([HARV_YEAR] <1991) and is Not Null) AND the harvest year is a number), OR ([BLK_SOURCE] = "AVI_1" Or "ORTHO" Or "GOV"):
Set [cPRE91] (calculated pre91 flag) field to 1
Set [cPost08] (calculated post 08 flag) field to 0
Set [cPost91] (calculated post 91 flag) field to 0.

9.5.5 STEP05 UPDATE cPOST91 FLAG

General Description:

For every record in the work space where (the skid year is greater than or equal to 1991([SKID_YEAR >=1991)) OR (the skid year is null AND the harvest year is greater than or equal to 1991) OR the SKID DATE >= March1,1991
Set [cPRE91] (calculated pre91 flag) field to 0
Set [cPost08] (calculated post 08 flag) field to 0
Set [cPost91] (calculated post 91 flag) field to 1.

*NOTE: This step overwrites the flags for those 1990 timber year blocks that were skid cleared between March1 and April 30 1991. The timber year starts on May1 but the Alberta post91 rules started out of synch with timber year by designating March 1, 1991 as the threshold date. This step moves those blocks to the post 91 category.

9.5.6 STEP06 UPDATE cPOST08 FLAG

General Description:

For every record in the work space where (the skid year is greater than 2008 ([SKID_YEAR >2008) OR (the skid year is null AND the harvest year is greater than 2008 ([HARV_YEAR] >2008)) OR (skid year is 0 or Null) AND ([BLK_SOURCE] = "gps" Or "plan" Or "layout"):

Set [cPRE91] (calculated pre91 flag) field to 0
Set [cPost08] (calculated post 08 flag) field to 1
Set [cPost91] (calculated post 91 flag) field to 0.

The photo updates are current to the end of the 2009 timber year in this blocks layer. Blocks known to be harvested in the 2009 and 2010 timber years are present (GPS line work from layout) and get flagged here as being post 2008 cuts. Also present are planned blocks that are flagged here so the TSA can be forced to harvest them later in the DFMP

process. All known planned blocks will be forced to be harvested in the TSA. This allows time 0 in the TSA model to be in the past (May 1, 2009) while having the modeled forest reflect reality.

9.5.7 STEP07 PRE91 AVI YC ASSIGNMENT

General Description:

For all cut portions of pre91 blocks ([cPRE91] = 1 and [BLK_CLASS] = “cut”):
Set [cAVI Strat FLAG] field to 1

All pre91 cuts are flagged to be stratified using the AVI call.

9.5.8 STEP08 PRE91, NO ARIS, AGE ASSIGNMENT

General Description:

For all cut portions of pre91 blocks where (harvest year is greater than 0 ([HARV_YEAR] >0)) AND (there is no valid ARIS entry ([cARIS_LINK] = 0 or null)):
OR
For all cut portions of pre91 blocks where (harvest year is greater than 0 ([HARV_YEAR] >0)) AND there is a valid ARIS opening ([cARIS_LINK] = 1) AND there is no valid skid clear date ([skid_year] = 0 or null)

set [cHarvest Year Flag] field to 1
set the assigned age field ([ASSIGNED AGE(YEARS)]) to (2009 – harvest year)

The cut portions of all pre91 blocks that have a known harvest year but do not have valid ARIS records are assigned an age based on harvest year. In these cases, the ARIS record is missing or incomplete and we know from other sources what the age is.

9.5.9 STEP09 PRE91, WITH ARIS, AGE ASSIGNMENT

General Description:

For all cut portions of pre91 blocks where (there is a valid ARIS link) ([cPRE91] = 1 and [BLK_CLASS] = “cut” or “CUT” and [cARIS_LINK] = 1):
set cARIS_Age Flag field to 1
set the assigned age field ([ASSIGNED AGE(YEARS)]) to (2009 – skid year)

The cut portions of all pre91 blocks that have valid ARIS records are assigned an age based on the ARIS skid year.

9.5.10 STEP10 PRE91, NO HARVEST AGE

General Description:

For all cut portions of pre91 blocks where (there is no harvest year AND there is no ARIS skid year) ([BLK_CLASS] = “CUT” or “cut” and [HARV_YEAR] = 0 or null and [SKID_YEAR] = 0 or null):
set [cARIS_Age Flag] field to 0
set [cAVI Age Flag] to 1

For pre91 cuts that have neither ARIS records nor local knowledge records of age, use AVI for age assignment.

9.5.11 STEP11 POST91, AGE ASSIGNMENT

General Description:

For all cut portions of post91 blocks ([cPOST91] = 1 and [BLK_CLASS = “cut”):
set [cARIS_Age Flag] field to 1
set [Assigned_Age (years)] field to (2009 – skid year) or (2009 – harvest year if skid year = 0)

For cut portions of post91 blocks, use the ARIS skid year for age assignment if it exists. If the ARIS skid year does not exist, then use HARV YEAR.(Harv Year is knowledge from sources other than ARIS)

9.5.12 STEP12 POST91, NO ARIS, YC ASSIGNMENT

General Description:

For all post91 blocks with no ARIS link ([cPOST91] = 1 and [cARIS_LINK] = 0 or null):
set [cAVI_Strat Flag] field to 1

All post91 blocks without a valid ARIS link are stratified using the AVI call.

9.5.13 STEP13 POST91, WITH ARIS, WITH REGEN SURVEY

General Description:

For all post91 blocks with a valid ARIS record AND (a valid Establishment Survey OR a valid Performance Survey):
Set the Assigned Yield Curve field to the yield curve set out in the Declared Strata lookup table.

For post 91 blocks with establishment or performance survey, set yield curve to a curve based on the declared path. The lookup table DECLARED STRATA contains the list of yield curves assigned to each declaration. This assumes that with each successive survey, the ARIS declaration is overwritten.

Relates:

The lookup table DECLARED STRATA is linked to the work space table through the declared regen code. This relate returns one record from the lookup for each record in the work table.

9.5.14 STEP14 POST91, WITH ARIS, NO SURVEY, WITH REGEN CODE

General Description:

For all post91 blocks with a valid ARIS record AND (no Establishment Survey AND no valid Performance Survey):
Set the Assigned Yield Curve field to the yield curve set out in the Declared Strata lookup table.

For post 91 blocks without any survey, set yield curve to a curve based on the declared path. The lookup table DECLARED STRATA contains the list of yield curves assigned to each declaration.

Relates:

The lookup table DECLARED STRATA is linked to the work space table through the declared regen code. This relate returns one record from the lookup for each record in the work table.

9.5.15 STEP15 POST91, WITH ARIS, NO SURVEY, NO REGEN CODE

General Description:

For all post91 blocks with a valid ARIS record AND (no Establishment Survey AND no valid Performance Survey): AND (no regen declaration)
Set the cAVI Strat Flag to 1

For post 91 blocks with ARIS records but with no surveys and no regen declaration, use AVI to stratify.

9.5.16 STEP16 POST91, WITH ARIS, NO SURVEY, REGEN CODE = PRE91

General Description:

For all post91 blocks with a valid ARIS record AND (no Establishment Survey AND no Performance Survey): AND (regen declaration = pr91)
Set the cAVI Strat Flag to 1

For post 91 blocks with ARIS records but with no surveys and a pr91 regen declaration, use AVI to stratify.

9.5.17 STEP17 RETENTION

General Description:

For all composite polygons where (block_status = Retention interior or retention exterior) :
Set the cAVI Strat Flag to 1
Set the cAVI Age flag to 1

For all retention patches, use AVI for both age and strata assignment. Do not set assigned age.

9.5.18 STEP18 REMOVALS, AVI OR TS

General Description:

These removals from blocks occur during the layout stage, when portions of block areas are deferred because the trees are not yet merchantable size. For all composite polygons where (block_class = removal) and (block_type = "AVI" Or "TS" Or "DE" Or "HT"):
Set the cAVI Strat Flag to 1
Set the cAVI Age flag to 1
Set Assigned Treatment flag to 0
Set Assigned Age(years) flag to 0
For all portions of block removed due to tree size, use AVI for both age and strata assignment. Do not set assigned age and do not set assigned strata.

9.5.19 STEP19 REMOVALS, NON MERCH

General Description:

These removals from blocks occur during the layout stage, when portions of block areas are deferred because they have no trees. For all composite polygons where (block_class = removal) and (block_type = "FA" Or "LU" Or "SH" Or "UN" Or "GR"):
Set the Assigned Yield Curve field to -1
Set the Assigned Landbase code to the appropriate value from the util NON MERCH LOOKUP table

Set the assigned age to 0.

For all portions of block removed due to openings, adjust the landbase code, assign an age of 0, and set the yield curve to a non-tree code..

9.5.20 STEP20 POST 2008

General Description:

For all harvestable post08 block fragments (deferrals and removals are ignored):
Set cAVI Age Flag to 1
Set cAVI Strat Flag to 1
Set Assigned Treatment to 1
Set Assigned harvest year to harvest year

The post08 blocks are prescheduled blocks that the TSA model will be forced to harvest in the first period. The assigned treatment value of 1 is a generic code that simply means 'harvest'. The harv_year input into this process was provided by the field planners at the time they were doing the GPS layout – it will be 2009 or 2010. The AVI is used for yield curve and age determination.

9.5.21 STEP21 ASSIGN D LBASE POST 91 CUTS

General Description:

For the cut portions of all post91 blocks where { [(The ARIS LBASE call starts with a letter D or H) AND (the FMU is P2 or P5 or S15)] OR [(The ARIS LBASE call starts the letter H)] } AND { The assigned yield curve is not -1 (ie hasn't been disqualified as deferral or removal) } :
Set the Assigned Lbase Field to "LD"

The ARIS LBASE_CODE uses 'D' to mean broad covergroup of 'DC" and 'H' (for hardwood) to mean broad covergroup of 'Deciduous'. This step uses string manipulation functions to pull these letter codes out of the ARIS lbase record. In FMUs P2, P5, and S15, DMI has deciduous rights in DC stands. Everywhere else, DMI has deciduous rights in D stands. This query pulls a recordset of harvestable post91 block fragments and assigns a LD landbase call into the assigned lbase field for those records belonging to the DMI LD lbase.

9.5.22 STEP22 ASSIGN C LBASE POST 91 CUTS

General Description:

For the cut portions of all post91 blocks where { [(The ARIS LBASE call starts with a letter C or S) AND (the FMU is P2 or P5 or S15)] OR [(The ARIS LBASE call starts the letter S

or C or D) AND (FMU is not P2 or P5 or S15)] } AND { The assigned yield curve is not -1 (ie hasn't been disqualified as deferral or removal) }:
Set the Assigned Lbase Field to "LC"

The ARIS LBASE_CODE uses 'C' to mean broad covergroup of 'CD" and 'S' (for softwood) to mean broad covergroup of 'Conifer'. This step uses string manipulation functions to pull these letter codes out of the ARIS lbase record. In FMUs P2, P5, and S15, DMI has deciduous rights in DC stands. Everywhere else, DMI has deciduous rights in only in D stands. This query pulls a recordset of harvestable post91 block fragments and assigns a LC landbase call into the assigned lbase field for those records belonging to the conifer lbase.

STEP23 ASSIGN C LBASE POST91 CUTS, NO LBASE_CODE

General Description:

For the cut portions of post91 blocks not already given a lbase code where (there is no ARIS Lbase code present) AND (the disposition was a conifer disposition):
Set Assigned Lbase to 'LC':

For post 91 blocks not already given a lbase code, with no ARIS landbase call, use the disposition it was harvested under (if known) to assign lbase. If the disposition was CTL, CTP, or LTP, then assign the block to the conifer landbase.

9.5.23 STEP24 ASSIGN D LBASE POST 91 CUTS, NO LBASE_CODE

General Description:

For the cut portions of post91 blocks not already given a lbase code where (there is no ARIS Lbase code present) AND (the disposition was a deciduous disposition):
Set Assigned Lbase to 'LD':
For post 91 blocks with no ARIS landbase call, use the disposition it was harvested under (if known) to assign lbase. If the disposition was DTL, DTP, or FMA, then assign the block to the conifer landbase.

9.5.24 STEP25 CATCH ANOMALIES

General Description:

This is a trouble shooting step left in the process from the development stage. If everything is correct, this query should never return a recordset.

STEP26 COPY DATA TO CUTOVER SUMMARY

General Description:

This step copies all records from work_temp to cutover summary. The entire process is now complete.

9.6 TABLE DEFINITIONS

TABLE 9-2. TABLE DEFINITIONS FOR ALL TABLES CONTAINED IN THE MS-ACCESS FILE CUTOVER STRATIFICATION JULY2011.MDB.

Table Name	Field Name	Data Type	Field Description
blk_details	OBJECTID	Double	Internal sequence number generated by geodatabase
	BLK_DET_ID	Double	BLOCK DETAILS IDENTIFIER: Unique key. Each record represents one opening record from ARIS
	OPEN_NUM	Text	ARIS OPENING NUMBER: ARIS opening number if known
	FMU	Text	FOREST MANAGEMENT UNIT: Based on historical records provided by operator.
	ARIS_FMU	Text	ARIS Forest Management Unit Code
	DISP_TYPE	Text	DISPOSITION TYPE: Forest Tenure disposition type under which cut was performed
	OP_AREA	Text	OPERATING AREA: License area before 2008. DMI Operating Area after 2009

Table Name	Field Name	Data Type	Field Description
	BLOCK_ID	Text	BLOCK IDENTIFIER: Annual Operating Plan Block Number
	SKID_DATE	Date/Time	ARIS SKID DATE: Date the block was skid cleared
	SKID_TYEAR	Double	SKID TIMBER YEAR: The timber year the block was skid cleared. (Timber years are May 1 to April 30)
	LBASE_CODE	Text	ARIS LANDBASE CODE: 2 character code explaining the "from lbase" and the "to lbase"
	REGEN_CODE	Text	ARIS REGENERATION DECLARATION CODE: Regen standard declared for the block
	HARV_AREA_HA	Double	ARIS DECLARED HARVEST AREA: Harvest area declared in hectares
	CON_VOL_M3	Double	CONIFER VOLUME: Reported harvest volume of Conifer in DMI blocks if known
	DEC_VOL_M3	Double	DECIDUOUS VOLUME: Reported harvest volume of Deciduous in DMI blocks if known
	HARV_STAT	Text	HARVEST STATUS: null = No ARIS record match(probably has been harvested); Cut = has been harvested; Plan = Laid out but not harvested yet
	SOURCE	Text	SOURCE: Information source for this record: Operator supplied
	SOURCE_BLK_NUM	Text	SOURCE_BLK: DMI internal flag
	CUTB_SEQ_NBR	Double	CUTBLOCK SEQUENCE NUMBER: DMI internal sequence number to link to

Table Name	Field Name	Data Type	Field Description
			GENUS records
	DISPBLK	Text	DISPOSITION BLOCK: AOP Disposition-Block Number
	SURV_TYPE	Text	SURVEY TYPE: Most Recent Regen Survey Type: Null = none; EST SURVEY = Establishment Survey; PER Survey = Performance Survey
	STOCK_STAT	Text	STOCKING STATUS:ARIS Regen standards stocking status
	TOT_STOCK	Double	TOTAL STOCKING: % Stocking of latest survey if one exists
	RETREAT	Text	RETREAT: Indicates Intent to retreat: Internal ARIS Flag.
	OP_REF_RES	Text	OPERATOR REFORESTATION RESPONSIBILITY: ARIS operator code for company holding liability
	BLK_UPD_NON_RET_	Double	Area of cut portions (non-retention) of blocks, in ha
blocks	HARV_YEAR	Double	HARVEST YEAR: Timber Year in which skid cleared
	BLK_CLASS	Text	BLOCK CLASS from BLOCKS feature class: CUT - harvested portion of block; RET- Retention; REM- Removals(only GPSd polys)
	BLK_TYPE	Text	BLOCK TYPE: from BLOCKS feature class: Type of block component: AVI – valid AVI stand completely enclosed within block; US- Understory protection; I-Internal ; X- proximal; UN-Unmerch; FA- Flood; GR- Grass;

Table Name	Field Name	Data Type	Field Description
			SH-Shrubs; TP-Topography; LU-LandUse feature; TS- Tree size; DE- Density; HT- height
	BLK_TYPE_S	Text	BLOCK TYPE STATUS from BLOCK feature class:Source of retention/removal data: P-Planned; U-Unplanned
	SOURCE	Text	BLOCK SOURCE: Where did the spatial representation for this block come from?: AVI_VI1 = 1989 DMI AVI; GOV = Alberta; GPS= GPS Update as built; PLAN= GPS Layout; UPDATE = Photo Update
	BLK_DET_ID	Double	BLOCK DETAILS IDENTIFIER: foreign key. Each record represents one opening record from ARIS in the Blk_details table
	DISPBLK	Text	DISPOSITION BLOCK:AOP Disposition-Block Number
	SHAPE_Leng	Double	Perimeter length in metres
	SHAPE_Area	Double	AREA in square metres
	BLOCKS_UK	Double	BLOCKS UNIQUE KEY: Primary key: Unique identifier for each spatial block fragment in the composite forest geodatabase layer
	BLOCKS_KEY	Double	BLOCKS KEY: Exactly same as BLOCKS_UK: Unique identifier for each spatial block fragment in the composite forest geodatabase layer
BLOCKS	BLOCKS_KEY	Long	Unique Identifier of polygons in

Table Name	Field Name	Data Type	Field Description
FMU LOOKUP			BLOCKS layer
	ASSIGNED FMU	Text	Assigned FMU
compforeast	All Fields		This is an autogenerated input table and as such has no metadata - see temp COMPFOR table for field descriptions
compforwest	All Fields		This is an autogenerated input table and as such has no metadata - see temp COMPFOR table for field descriptions
compforsyu	All Fields		This is an autogenerated input table and as such has no metadata - see temp COMPFOR table for field descriptions
CUTOVER SUMMARY	BLOCKS_UK	Long	BLOCKS UNIQUE KEY: Unique identifier of input feature class BLOCKS
	BLK_DET_ID	Double	Unique identifier assigned to each record in the Blocks Details table
	OPEN_NUM	Text	ARIS Opening number
	DISPBLK	Text	Disposition Block:Concatenation of disposition and block number
	STOCK_STAT	Text	Stocking Status: null; CSR, FTG,NSR,RTD,SR
	SOURCE	Text	Source of cutblock information: <company>; MTU; FRIA
	OP_AREA	Text	Operating Area = Cut disposition: License/compartment numbers, MOF flag

Table Name	Field Name	Data Type	Field Description
	BLOCK_ID	Text	Number assigned to block when harvested, if known. Only Unique within a license within a timber year
	FMU	Text	Forest Management Unit: F1, P1S, P2, P3, P4, P5, P10, S15, P11, P1N
	ARIS_FMU	Text	ARIS FMU alphanumeric codes:
	DISP_TYPE	Text	Disposition Type: Type of disposition such as CTP, CTL, FMA, MOF, LTP. EMEND, FMA,
	SKID_DATE	Date/Time	Date that timber was skid-cleared
	SKID_YEAR	Double	The 4-digit timber-year that harvesting occurred in. If skid-cleared between May 02/1998 and May01/1999, then 1998 was used.
	SURV_TYPE	Text	Survey type conducted (Establishment or Performance): Est Survey; Per Survey
	LBASE_CODE	Text	Landbase code as per ARIS Industry Operations Manual, Appendix C - Domain Codes
	REGEN_CODE	Text	Regeneration code as per ARIS Industry Operations Manual, Appendix C - Domain Codes
	CON_VOL	Long	Conifer Harvest Volume if known
	DEC_VOL	Long	Deciduous Harvest Volume if known
	SOURCE_BLK_NUM	Text	Source Block Number: Block Numbers provided by source - not always valid
	CUTB_SEQ_NBR	Long	Cut Block Sequence Number: Source Provided Block 'number'

Table Name	Field Name	Data Type	Field Description
			alphanumeric code
	HARV_STAT	Text	Block status: Null; Cut; Planned; future
	AREA_HA	Double	Area in hectares
	BLK_STATUS	Text	BLOCK STATUS from BLOCKS feature class: CUT- block cut and photo confirmed, PLANNED - block laid out with GPS, FUTURE - future block, RET_INT - retention internal to block, RET_EXT - retention external to block
	BLK_SOURCE	Text	BLOCK SOURCE from BLOCKS feature class: Where did the spatial data come from? AVI_v1 = AVI 1989; GPS = layout; Plan = AOP planning; Update = photo update
	BLK_CLASS	Text	BLOCK CLASS from BLOCKS feature class: CUT - harvested portion of block; RET- Retention; REM- Removals(only GPSd polys)
	BLK_TYPE	Text	BLOCK TYPE: from BLOCKS feature class: Type of block component: US- Understory protection; I-Internal ; X-proximal; UN- Unmerch; FA-Flood; GR- Grass; SH-Shrubs; TP-Topography; LU- LandUse feature; TS- Tree size; DE-Density; HT- height
	BLK_TYPE_STAT	Text	BLOCK TYPE STATUS from BLOCK feature class:Source of retention/removal data: P-Planned; U-Unplanned
	SHAPE_AREA	Long	Polygon (from BLOCKS feature

Table Name	Field Name	Data Type	Field Description
			class) area in meters squared
	HARV_YEAR	Long	HARVEST YEAR: DMI manual assignment of harvest year from many sources from BLOCKS feature class
	RETREAT	Text	ARIS flag for NSR CSR stands requiring retreatments
	OP_REF_RES	Text	OPERATOR with REFORESTATION RESPONSIBILITIES
	TOT_STOCK	Long	ARIS Total Stocking Percentage
	cPOST91	Long	CALCULATED POST91 FLAG: Is this record Post 91? 1=Yes or 0=No
	cPRE91	Long	PRE91 block? : 1 = yes, 0 = no
	cPOST08	Long	POST 2008 block?: 1 = yes, 0 = no
	cARIS_LINK	Long	CALCULATED ARIS LINK: Does this record have an ARIS Record? 1= Yes or 0=No
	cCUT_TYPE	Long	CALCULATED CUT TYPE: Not used in this submission – INTERNAL DMI use
	cARIS_AGE FLAG	Long	CALCULATED ARIS AGE FLAG: Does this record have an ARIS skid timber year? 1= yes; 0 = no
	cHARVEST YEAR FLAG	Long	CALCULATED HARVEST YEAR: DMI manual assignment of harvest year from many sources: 1 = yes; 0 = no
	cAVI AGE FLAG	Long	CALCULATED AVI AGE FLAG: Use AVI origin. 1 = yes; 0= no
	cAVI Strat FLAG	Long	CALCULATED AVI STRATIFICATION FLAG: 1 =

Table Name	Field Name	Data Type	Field Description
			yes; 0=no
	ASSIGNED YC	Long	ASSIGNED PATHWAY: G&Y 2009 valid pathways assigned by stratification routine
	ASSIGNED AGE(YEARS)	Long	ASSIGNED AGE: Age(years) assigned by stratification routine
	ASSIGNED TREATMENT	Long	Assigned Treatment: For prescheduled blocks in Woodstock model. Harvest treatment code
	ASSIGNED TREATMENT YEAR	Long	Assigned Treatment year: For prescheduled blocks in Woodstock Model. Future harvest year if known.
	ASSIGNED LBASE	Text	Assigned Land Base based on strata declaration and FMU
DECLARED STRATA	REGEN CODE	Text	ARIS regen code declaration
	ASSIGNED YC	Long	G&Y2008 PATHWAY
Qry_list	internal_id	Long	internal id
	initial_order	Text	ORDER TO EXECUTE INITIALIZATION ACTIONS
	compile order	Text	ORDER TO INITIALIZE COMPILATION ACTIONS
	clean_order	Text	ORDER TO EXECUTE CLEAN UP ACTIONS
	sort_order	Long	ORDER TO EXECUTE QRY_LIST
	query_name	Text	NAME OF QUERY
	query_description	Text	DESCRIPTION OF WHAT

Table Name	Field Name	Data Type	Field Description
			QUERY DOES
temp COMPFOR	CMPKEY	Double	COMPOSITE FOREST PRIMARY KEY: Unique key assigned to each composite forest polygon
	PID	Decimal	Polygon identifier: unique to an interpreted polygon within a township, from 1 to 9999.
	MER	Decimal	Meridian: 5-6
	TWP	Decimal	Township: 82-103
	RGE	Decimal	Range: 1-26
	FORESTKEY	Text	Concatenated forestkey : PID, TWP, RGE, MER
	POLYID	Double	Unique standpoly id (smallest avi entity) in the ORACLE master database storing the AVI
	STANDID	Long	Unique STANDID (larger avi entity) in the ORACLE master database storing the AVI **DMI INTERNAL USE ONLY**
	CUTKEY07	Double	Unique identifier assigned to each polygon in the cutblocks2007 update coverage. – LEGACY; NOT USED IN THIS SUBMISSION
	BLOCKS_KEY	Long	Unique identifier of record from blocks input feature class
	VI1_POLYID	Double	Unique polygon ID - Link into old Vegetation Inventory (AVI1) attributes (only within cutblocks)
	GRAZING_KEY	Long	Unique identifier of record from input feature Grazing

Table Name	Field Name	Data Type	Field Description
	CATCHKEY	Long	Unique identifier assigned to each polygon in the gauging-station catchment input feature.
	PARK_KEY	Long	Unique identifier of record from Parks input feature class
	FMA	Double	FMA flag: 0 - not within the FMA, 1 - within the FMA
	FMU	Text	Forest Management Unit - f1,p1N, P1S,p2,p3,p4,p5,p10, P11,s15
	COMPARTMENT	Text	DMI Compartment name/number
	OP_AREA	Text	DMI Operating Areas
	TRAPNO	Text	Trapline number (provincial unique identifier)
	ZONENUM	Long	Number assigned to each cost zone. Only unique within one of three groups of FMUs -LEGACY INTERNAL DMI USE ONLY
	ZONENAME	Text	Name assigned to each cost zone. If no name assigned, the name corresponds to the zone number. – LEGACY INTERNAL DMI USE ONLY
	CARIBOU	Long	Caribou range flag as follows: 0 - not within caribou range, 1 - within caribou range
	TEARDROP	Double	Lubicon traditional area flag as follows: 0 - not within teardrop, 1 - within teardrop
	FMADEL	Double	Appendix “A” deletions as follows: 0 - not an Appendix “A” deletion, 1 - Appendix “A” deletion – LEGACY NOT USED IN THIS SUBMISSION

Table Name	Field Name	Data Type	Field Description
	IRTAG	Text	Native Reserves within the Appendix A deletions as follows:LUB - Lubicon, LCASET - Settlement areas adjacent to reserves, WC - Woodland Cree IR, LRC - Loon River Cree
	GRAZING	Long	Grazing range flag as follows: 0 - not within Grazing area, 1 - within Grazing area
	BREAK	Double	Area of topographic concern: 1 - Area within incised valley, 2 - Area of rugged terrain, 3 - Area too steep to operate
	HYDROBUF	Text	Type of area buffered around each hydrographic type
	FIRENUM	Text	Unique name assigned to each fire
	FIREYEAR	Double	The 4-digit year during which the fire occurred.
	LU FLAG	Long	Binary flag indicating other disturbances, mainly due to oil-and-gas activity
	MOOSE	Long	Moose range flag as follows:0 - not within moose zone, 1 - within River Valley moose zone, 2 - within Upland moose zone
	NATURAL	Text	Natural sub-regions: CMW - Central Mixed Wood, DMW - Dry Mixed wood, LBH - Lower Boreal Highlands, UBH - Upper Boreal Highlands
	WAM	Long	Wet Area Mapping based on the depth of the water table: 1 - 0.00 to 0.10m, 2 - 0.10 to 0.25m, 3 - 0.25 to 0.50m, 4 - 0.50 to 1.00m

Table Name	Field Name	Data Type	Field Description
	RESERVATION	Text	Area with timber harvesting restriction: PNT, Recreation, Research, Sample plots
	MPB_SR	Text	Mountain Pine Beetle Susceptibility Rating
	FIRENUMBER	Text	Firenumber from input feature class fires
	LUCLASS	Text	land use class value
	CRN	Long	Continuous reserve network value
	BLK_STATUS	Text	Block Status:CUT- block cut and photo confirmed, PLANNED - block laid out with GPS, FUTURE - future block, RET_INT - retention internal to block, RET_EXT - retention external to block
	SHAPE_LENGTH	Long	Shapefile autogenerated polygon perimeter in metres
	SHAPE_AREA	Long	Shapefile autogenerated polygon area in metres squared
	TREEDAREAHA	Double	Area in Hectares of each composite forest polygon minus any overlapping seismic disturbance (seismic line buffered by 5m)
	AREAHA	Double	Area in Hectares of each composite forest polygon
WORK_TEMP	BLOCKS_UK	Long	BLOCKS UNIQUE KEY: Unique identifier of input feature class BLOCKS
	BLK_DET_ID	Double	Unique identifier assigned to each record in the Blocks Details

Table Name	Field Name	Data Type	Field Description
			table
	OPEN_NUM	Text	ARIS Opening number
	DISPBLK	Text	Disposition Block:Concatenation of disposition and block number
	STOCK_STAT	Text	Stocking Status: null; CSR, FTG,NSR,RTD,SR
	SOURCE	Text	Source of cutblock information: <company>; MTU; FRIA
	OP_AREA	Text	Operating Area = Cut disposition: License/compartment numbers, MOF flag
	BLOCK_ID	Text	Number assigned to block when harvested, if known. Only Unique within a license within a timber year
	FMU	Text	Forest Management Unit: F1, P1S, P2, P3, P4, P5, P10, S15, P11, P1N
	ARIS_FMU	Text	ARIS FMU alphanumeric codes:
	DISP_TYPE	Text	Disposition Type: Type of disposition such as CTP, CTL, FMA, MOF, LTP. EMEND, FMA,
	SKID_DATE	Date/Time	Date that timber was skid-cleared
	SKID_YEAR	Double	The 4-digit timber-year that harvesting occurred in. If skid-cleared between May 02/1998 and May01/1999, then 1998 was used.
	SURV_TYPE	Text	Survey type conducted (Establishment or Performance): Est Survey; Per Survey

Table Name	Field Name	Data Type	Field Description
	LBASE_CODE	Text	Landbase code as per ARIS Industry Operations Manual, Appendix C - Domain Codes
	REGEN_CODE	Text	Regeneration code as per ARIS Industry Operations Manual, Appendix C - Domain Codes
	CON_VOL	Long	Conifer Harvest Volume if known
	DEC_VOL	Long	Deciduous Harvest Volume if known
	SOURCE_BLK_NUM	Text	Source Block Number: Block Numbers provided by source - not always valid
	CUTB_SEQ_NBR	Long	Cut Block Sequence Number: Source Provided Block 'number' alphanumeric code
	HARV_STAT	Text	Block status: Null;Cut; Planned; future
	AREA_HA	Double	Area in hectares
	BLK_STATUS	Text	BLOCK STATUS from BLOCKS feature class: CUT- block cut and photo confirmed, PLANNED - block laid out with GPS, FUTURE - future block, RET_INT - retention internal to block, RET_EXT - retention external to block
	BLK_SOURCE	Text	BLOCK SOURCE from BLOCKS feature class: Where did the spatial data come from? AVI_v1 = AVI 1989; GPS = layout; Plan = AOP planning; Update = photo update
	BLK_CLASS	Text	BLOCK CLASS from BLOCKS feature class: CUT - harvested portion of block; RET- Retention; REM- Removals(only GPSd

Table Name	Field Name	Data Type	Field Description
			polys)
	BLK_TYPE	Text	BLOCK TYPE: from BLOCKS feature class: Type of block component: AVI – Valid AVI stand completely enclosed within block;US- Understory protection; I-Internal ; X- proximal; UN-Unmerch; FA- Flood; GR- Grass; SH-Shrubs; TP-Topography; LU-LandUse feature; TS- Tree size; DE- Density; HT- height
	BLK_TYPE_STAT	Text	BLOCK TYPE STATUS from BLOCK feature class:Source of retention/removal data: P-Planned; U-Unplanned
	SHAPE_AREA	Long	Polygon (from BLOCKS feature class) area in meters squared
	HARV_YEAR	Long	HARVEST YEAR: DMI manual assignment of harvest year from many sources from BLOCKS feature class
	RETREAT	Text	ARIS flag for NSR CSR stands requiring retreatments
	OP_REF_RES	Text	OPERATOR with REFORESTATION RESPONSIBILITIES
	TOT_STOCK	Long	ARIS Total Stocking Percentage
	cPOST91	Long	CALCULATED POST91 FLAG: Is this record Post 91? Yes or No
	cPRE91	Long	PRE91 block? : 1 = yes, 0 = no
	cPOST08	Long	POST 2008 block?: 1 = yes, 0 = no
	cARIS_LINK	Long	CALCULATED ARIS LINK: Does this record have an ARIS

Table Name	Field Name	Data Type	Field Description
			Record? Yes or No
	cCUT_TYPE	Long	CALCULATED CUT TYPE: 1 - 8
	cARIS_AGE FLAG	Long	CALCULATED ARIS AGE FLAG: Does this record have an ARIS skid timber year? 1= yes; 0 = no
	cHARVEST YEAR FLAG	Long	CALCULATED HARVEST YEAR: DMI manual assignment of harvest year from many sources: 1 = yes; 0 = no
	cAVI AGE FLAG	Long	CALCULATED AVI AGE FLAG: Use AVI origin. 1 = yes; 0= no
	cAVI Strat FLAG	Long	CALCULATED AVI STRATIFICATION FLAG: 1 = yes; 0=no
	ASSIGNED YC	Long	ASSIGNED PATHWAY: G&Y 2009 valid pathways
	ASSIGNED AGE(YEARS)	Long	ASSIGNED AGE: Age(years) assigned by stratification routine
	ASSIGNED TREATMENT	Long	Assigned Treatment: For prescheduled blocks in Woodstock model. Harvest treatment code
	ASSIGNED TREATMENT YEAR	Long	Assigned Treatment year: For prescheduled blocks in Woodstock Model. Future harvest year if known.
	ASSIGNED LBASE	Text	Assigned Lbase based on strata declaration and FMU

9.7 CUTBLOCK STRATIFICATION SUMMARY FOR FMA WEST

The following table shows the stratification types used for each landbase on the FMA West. The cutblocks are broken down into pre and post 1991 cutblocks.

Sum of SumOfTREEDAREAHA				
MODEL LANDBASE	STRATIFICATION TYPE	status	SURV_TYPE	Total
⊟LC	⊟CUT ASSIGNED YC ASSIGNED AGE	⊟POST 91		18,938
			EST SURVEY	4,255
		POST 91 Total		23,193
	CUT ASSIGNED YC ASSIGNED AGE Total			23,193
	⊟CUT AVI YC ASSIGNED AGE	⊟POST 91		568
		POST 91 Total		568
		⊟PRE 91		4,026
		PRE 91 Total		4,026
	CUT AVI YC ASSIGNED AGE Total			4,594
	⊟CUT AVI YC AVI AGE	⊟PRE 91		1,684
		PRE 91 Total		1,684
	CUT AVI YC AVI AGE Total			1,684
	⊟DEFAULT AVI	⊟PRE 91		3
		PRE 91 Total		3
	DEFAULT AVI Total			3
	⊟POST AVI BURN	⊟POST 91		70
			EST SURVEY	0
		POST 91 Total		70
	POST AVI BURN Total			70
	⊟ref-cc-burn	⊟POST 91		87
		POST 91 Total		87
	ref-cc-burn Total			87
	⊟RETENTION	⊟POST 91		481
			EST SURVEY	527
		POST 91 Total		1,009
	RETENTION Total			1,009
LC Total				30,640
⊟LD	⊟CUT ASSIGNED YC ASSIGNED AGE	⊟POST 91		2,085
			EST SURVEY	13,034
			PER SURVEY	1,902
		POST 91 Total		17,021
	CUT ASSIGNED YC ASSIGNED AGE Total			17,021
	⊟CUT AVI YC ASSIGNED AGE	⊟POST 91		20
		POST 91 Total		20
		⊟PRE 91		17,440
		PRE 91 Total		17,440
	CUT AVI YC ASSIGNED AGE Total			17,459
	⊟CUT AVI YC AVI AGE	⊟PRE 91		4,867
		PRE 91 Total		4,867
	CUT AVI YC AVI AGE Total			4,867
	⊟DEFAULT AVI	⊟PRE 91		77
		PRE 91 Total		77
	DEFAULT AVI Total			77
	⊟POST AVI BURN	⊟POST 91		3
		POST 91 Total		3
		⊟PRE 91		2
		PRE 91 Total		2
	POST AVI BURN Total			4
	⊟RETENTION	⊟POST 91		292
			EST SURVEY	624
		POST 91 Total		916
	RETENTION Total			916
LD Total				40,345
⊟LE	⊟CUT ASSIGNED YC ASSIGNED AGE	⊟POST 91		712
			EST SURVEY	275
			PER SURVEY	137
		POST 91 Total		1,124
	CUT ASSIGNED YC ASSIGNED AGE Total			1,124
	⊟CUT AVI YC ASSIGNED AGE	⊟POST 91		750
		POST 91 Total		750
	CUT AVI YC ASSIGNED AGE Total			750
LE Total				1,874
⊟NA	⊟CUT AVI YC ASSIGNED AGE	⊟POST 91		0
		POST 91 Total		0
		⊟PRE 91		88
		PRE 91 Total		88
	CUT AVI YC ASSIGNED AGE Total			88
	⊟CUT AVI YC AVI AGE	⊟PRE 91		32
		PRE 91 Total		32
	CUT AVI YC AVI AGE Total			32
	⊟RETENTION	⊟POST 91		2
			EST SURVEY	3
		POST 91 Total		5
	RETENTION Total			5
NA Total				125
⊟NN	⊟CUT AVI YC ASSIGNED AGE	⊟PRE 91		63
		PRE 91 Total		63
	CUT AVI YC ASSIGNED AGE Total			63
	⊟CUT AVI YC AVI AGE	⊟PRE 91		8
		PRE 91 Total		8
	CUT AVI YC AVI AGE Total			8
	⊟RETENTION	⊟POST 91		0
			EST SURVEY	1
		POST 91 Total		1
	RETENTION Total			1
NN Total				71
⊟VA	⊟CUT AVI YC ASSIGNED AGE	⊟PRE 91		97
		PRE 91 Total		97
	CUT AVI YC ASSIGNED AGE Total			97
	⊟CUT AVI YC AVI AGE	⊟PRE 91		23
		PRE 91 Total		23
	CUT AVI YC AVI AGE Total			23
	⊟RETENTION	⊟POST 91		1
			EST SURVEY	1
		POST 91 Total		1
	RETENTION Total			1
VA Total				120
⊟VN	⊟CUT AVI YC ASSIGNED AGE	⊟PRE 91		327
		PRE 91 Total		327
	CUT AVI YC ASSIGNED AGE Total			327
	⊟CUT AVI YC AVI AGE	⊟PRE 91		327
		PRE 91 Total		327
	CUT AVI YC AVI AGE Total			327
	⊟ref-cc-burn	⊟POST 91		1
		POST 91 Total		1
	ref-cc-burn Total			1
	⊟RETENTION	⊟POST 91		66
			EST SURVEY	56
		POST 91 Total		122
	RETENTION Total			122
VN Total				778
Grand Total				73,953

10 YIELD CURVE SUMMARY

The document ***Growth and Yield Information Package 2011*** describes the yield curve stratification process. A summary is provided here for reference purposes.

Table 10-1 lists the Yield Strata that form the stratification to model growth and yield. Yield Strata '0' represents non-forested stands. Yield Strata '13' represents black spruce stands that will be part of the inactive landbase.
In the table below, AVI tree species abbreviations were used in the description.

TABLE 10-1 LIST OF YIELD STRATA AND ASSOCIATED DESCRIPTIONS THAT DEFINED THE LANDBASE STRATIFICATION

(1) STRATA	(2) STRATA LABEL	(3) MODEL TYPE	(4) GENERAL DESCRIPTION
0	Non Forested	N.F.	No Trees in the overstory or understory
1	Aspen >> Shrub	SUCC.	Aw dominated stands that succeed to open Aw and/or closed shrub stands
2	Aspen >> White spruce	SUCC.	Aw dominated stands that succeed late to open Sw stands with no overstory mixedwood phase in between.
3	Aspen >> Late Mixedwood >> White spruce	SUCC.	Aw dominated stands that succeed to Sw dominated stands with a late and well defined overstory mixedwood phase in between.
4	Aspen >> Early Mixedwood >> White spruce	SUCC.	Aw dominated stands that succeed to Sw dominated stands with an early and well defined overstory mixedwood phase in between.
5	Mixedwood >> White spruce	SUCC.	Aw leading mixedwood stands that succeed early to Sw dominated stands.
6	White spruce >> White spruce	SUCC.	Sw leading or Sw dominated stands that succeed to or remain Sw dominated stands over time. This stand type represents the eventual convergent pathway for Pathways 3, 4 and 5.

(1) STRATA	(2) STRATA LABEL	(3) MODEL TYPE	(4) GENERAL DESCRIPTION
7	Pine	STAT.	At least 80% Pl composition in the stand.
8	Pine-Black spruce-Deciduous	STAT.	Pl or Sb leading with at least 20% deciduous component.
9	Deciduous-Pine-Black spruce	STAT.	Deciduous leading with at least 20% Pl and/or Sb component.
10	Pine-White spruce	STAT.	At least 20% Pl with at least 20% Sw
11	Balsam Poplar >> Shrub	SUCC.	Pb dominated stand that succeeds to an open Pb and/or closed shrub stand
12	Black spruce-Pine-White spruce	STAT.	At least 20% Sb with at least 20% Pl or at least 20% Sb with at least 20% Sw
13	Black spruce	STAT.	At least 80% Sb + Lt component

Aw-Aspen; Bw-White birch; Pb-Balsam poplar; Pl-Lodgepole pine; Pj-Jack pine; Lt-Larch; Sb-Black spruce; Sw-White spruce; Fb-Balsam fir. Model Types are: N.F. -Non Forested; SUCC-Succession based Yield Strata; STAT- Static based Yield Strata

10.1 STRATIFICATION METHODS

Four distinct stand-structure criteria and one decision based criteria are used in the stratification routines to define pathways. In summary, these are:

Landbase: structure based criteria

Coverstate: structure based criteria (based on the provincial broad-cover group model)

Seral Stage: structure based criteria (a stand age class grouping)

Tree species: structure based criteria

Matrix: decission based criteria

A generalized flow and relationship between the criteria and pathways is provided in Figure 10-1 Generlized flow and relationship of criteria to the final pathways The structure criteria are based on specific stand structures while the decision matrix is used to determine specific static and succession based pathways. Each of the above five-criteria is described in more detail in the following subsections.

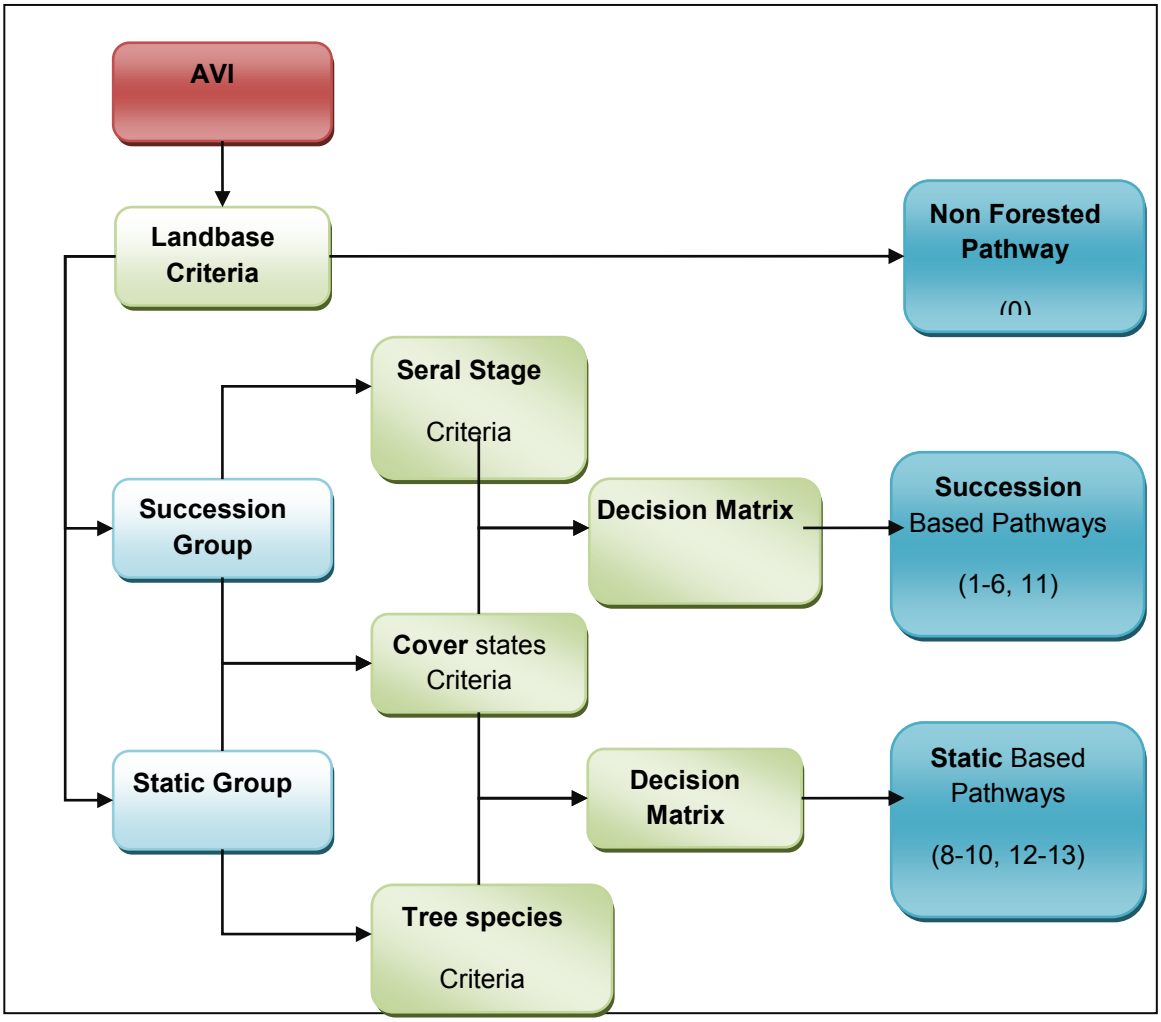


FIGURE 10-1 GENERLIZED FLOW AND RELATIONSHIP OF CRITERIA TO THE FINAL PATHWAYS

10.2 LANDBASE CRITERIA

This set of criteria classifies the forest into three broad groups:

those stands that are non-forest

those stands that will be part of age-dependent (succession) based pathways

those stands that will comprise the age-independent (static) based pathways

The criteria are based on three variables calculated from the AVI attribute dataset:

NF (Non-Forested): A binomial variable differentiating stands that do "not" have trees in the overstory or understory (NF = 1) from stands that "have" trees in the overstory or understory (NF = 0)

PXSBLT: The total overstory tree species composition (to the nearest 10 percent) of aggregated pine species (PX), black spruce (SB) and larch (LT) (i.e., overstory pine species % + overstory black spruce % + overstory larch %)

uPXSBLT: The total understory tree species composition (to the nearest 10 percent) of aggregated pine, black spruce and larch (i.e., understory pine species % + understory black spruce % + understory larch %)

The resulting variables are then used to divide the land-base into three broad groups of stands:

Non-forested stands: (i.e., NF = 1)

Succession Group: Forested stands that did not have a significant proportion of pine, black spruce or larch (i.e., NF = 0 and PXSBLT <= 20% and uPXSBLT <= 40%)

Static Group: Forested stands that did have a significant proportion of pine, black spruce or larch (i.e., NF = 0 and PXSBLT > 20% or uPXSBLT > 40%)

10.3 COVERSTATE CRITERIA

The coverstate classification is summarized in Table 10-2. The set of criteria that define coverstates is based on the provincial overstory broad cover group classification (i.e., D,

DC, CD, C). However, several refinements are made: First, the 'Cp' and 'Cd' coverstates represent a further stratification of 'C' stands. The C designation is used exclusively for the static based group while the Cp and Cd designation is used exclusively for the succession group. Secondly, stands with overstories dominated by deciduous tree species (D) and having coniferous tree species in the understory are assigned to one of three classifications (Du1, Du2, Du3), depending on the relative height difference between the overstorey and understorey.

TABLE 10-2 COVERSTATE CLASSIFICATION.

Note that the 'Cp' and 'Cd' coverstates represent a refinement of the 'C' coverstate

LABEL	CRITERIA
C	>=80% of the overstory trees are coniferous species
Cp	100% of the overstory trees are coniferous species
Cd	80 to 99% of the overstory trees are coniferous species
CD	At least 50% of the overstory trees are coniferous species and at least 21% are deciduous species
DC	At least 50% of the overstory trees are deciduous species and at least 21% are coniferous species
Du1	At least 80% of the overstory trees are deciduous species and at least 'A' density coniferous tree species in the understory that are between 3 and 6 meters of the overstory height.
Du2	At least 80% of the overstory trees are deciduous species and at least 'A' density coniferous tree species in the understory that are between 6 and 9 meters of the overstory height.
Du3	At least 80% of the overstory trees are deciduous species and at least 'A' density coniferous tree species in the understory that are greater than 9 meters of the overstory height.
D	At least 80% of the overstory trees are deciduous tree species and less then 6% cover of conifer trees in the understory.

10.4 SERAL STAGE CRITERIA

Table 10-3 summarizes the seral stage classification. Seral stages are based on AVI age, which is the stand (polygon) age calculated from the overstory stand-origin field (AEP 1991). In conjunction with the coverstate criteria summarized in 0, seral stages represent the defining construct of the succession model used to delineate the succession based pathways.

TABLE 10-3 SERAL STAGE CLASSIFICATION

SERAL STAGE	CRITERIA
1	AVI age > 0 and < 30 years
2	AVI age >= 30 and < 70 years
3	AVI age >= 70 and < 110 years
4	AVI age >= 110 and < 150years
5	AVI age >= 150 years

10.5 TREE SPECIES CRITERIA

Tree species criteria are used to futher subdivide stands according to meaningfull tree-species relationships. Specifically, it further subdivides conifer dominated stands in the 'Static' group. The following variables are calculated from the tree species compositional information found in the AVI attribute data:

tPX = the total proportion of pine species in the combined overstory and understory
tSB = the total proportion of black spruce in the combined overstory and understory
tLT = the total proportion of larch in the combined overstory and understory

tSW = the total proportion of white spruce in the combined overstory and understory
tFB = the total proportion of balsam fir in the combined overstory and understory

10.6 DECISION MATRIX

The succession based pathways defined using the decision matrix area summarized in Table 10-4. Using a combination of coverstates and seral stages the matrix is the driving criteria for the succession based pathways and together, reflect the succession model developed specifically for AVI data. In its simplest form there are three defining characteristics of the succession model:

Coverstates change over time: Although this appears not so true for Pathway 6 and not at all for Pathways 1 and 11, as these pathways appear static, it is important to note that all stands in the succession group are parts of an original whole sorted by succession rules. Thus Pathway-1 is not the same as say, the static Pathway-7 (Pine) since this pathway includes stands having coniferous understorey and stands having no conifeorous understorey, while Pathway-1 represents only stands with no coniferous understorey.

The model is purally deterministic: All stands having the same coverstate, no matter the stand age, are on the same trajectory. Although stochastity is an important component of replacement and convergant dynamics it would be impractical, and with the coarse level AVI data that is used, nearly impossible, to model stochasticity into a meaningful and working stratification for Growth & Yield. The impracticality would show itself quickly once Timber Supply Anslysis is carried out, which is of itself a "what-if" modeling system. Furthermore, the coarsness of the model, and its simplicity, reflects the relative simplicity of succession itself in the Boreal region, which is far more deterministic when compared to other forested regions of the world.

Mixedwood stands are converging to Pathway-6: Pathway-6 "White Spruce>>White Spruce" is the convergent pathway and hence the eventual coverstate, for the mixedwood pathways 2, 3, 4 and 5. Therefore, over time, these pathways will deterministically change coverstate to equal that of Pathway 6. However, this will occur at different times (or age-classes) with the lower numbered pathways converging later then the higher numbered pathways. Also, because Pathway 5 converges to Pathway 6 earlier and at the younger stand ages captured by the AVI, the pathway shares same coverstate 'Cp' at the last seral stage. If enough older stands were captured by the AVI, Table 10-4 would show Pathways 2, to 4 converging on Pathway 6 as well.

TABLE 10-4 DECISION MATRIX FOR THE SUCCESSION BASED PATHWAYS.

Numbers in bold-brackets reference the section pertaining to the structure-criteria. N/A means that the structure criteria were not applied to that particular pathway. PB is the percent of balsam poplar in the overstory and further subdivides D stands into Pathways 1 & 11

(10.4) SERAL STAGE (class/years)					PATHWAY	
0 – 29	30 – 69	70 – 109	110 – 149	150+	No.	Label
D	D	D	D	D	1	Aspen >> Shrub (PB <=20%)
					11	Balsam Poplar >> Shrub (PB > 20%)
Du3	Du3	Du3, Du2	Du3, Du2, Du1	Du3, Du2, Du1, DC	2	Aspen >> White Spruce
Du2	Du2	Du1	DC	CD	3	Aspen>>Late Mixedwood >>White Spruce
Du1	Du1	DC	CD	Cd	4	Aspen>>Early Mixedwood >> White Spruce
DC	DC	CD	Cd	Cp	5	Aspen Leading Mixedwood >> White Spruce
CD, Cd, Cp	CD, Cd, Cp	Cd, Cp	Cp	Cp	6	White Spruce >> White Spruce

The static based pathways defined using the decision matrix are summarized in Table 10-5 0. The destinguishing characteristicof the static based pathways versus the succession based ones is the absence of seral-stages criteria and usage of individual tree species criteria. Thus, Pathways 8 & 9 for example, always remains CD and DC, respectively, regardless of the stand age.

TABLE 10-5 DECISION MATRIX FOR THE STATIC BASED PATHWAYS.

Numbers in bold-brackets reference the section pertaining to the structure-criteria. N/A means that the structure criteria were not applied to that particular pathway

(10.3) COVERSTATE	**(10.5)**	PATHWAY

	TREE SPECIES	No.	Label
DC	N/A	9	Deciduous-Pine-Black Spruce
CD	N/A	8	Pine-Black Spruce-Deciduous
C	tPX>= 80%	7	Pine
	tSW+tFB >= 20% and tPX >= tSB+tLT	10	Pine-White Spruce
	tSW+tFB < 20% OR tSW+tFB >= 20% and tPX < tSB+tLT	12	Black Spruce-White Spruce
	tSB+tLT >= 80%	13	Black Spruce

The following Table 10-6 provides the criterion matrix used to assign Yield strata to AVI. Details on the stratification criteria were provided in the Framework Document

TABLE 10-6 *CRITERION MATRIX TO ASSIGN YIELD STRATA TO FOREST STANDS*

(1) MODEL TYPE	(2) LEVEL 1 CRITERION	(3) LEVEL 2 CRITERION					(4) LEVEL 3 CRITERION	(5) PATHWAY	
		0 – 29 yrs.	30 – 69 yrs.	70 – 109 yrs.	110 – 149 yrs.	Seral Stage 5 150+ yrs.		No.	Label
N.F.	NF=1	n/a	n/a	n/a	n/a	n/a	n/a	0	Non Forested
Succession	OR uPXSBLT <= 40%	D	D	D	D	D	PB <= 20%	1	Aspen >> Shrub
		D	D	D	D	D	PB > 20%	11	Balsam Poplar >> Shrub
		Du3	Du3	Du3, Du2	Du3,Du2,Du1	Du3,Du2,Du1, DC	n/a	2	Aspen >> White Spruce
		Du2	Du2	Du1	DC	CD	n/a	3	Aspen>>Late Mixedwood >>White Spruce
		Du1	Du1	DC	CD	Cd	n/a	4	Aspen>>Early Mixedwood >> White Spruce
		DC	DC	CD	Cd	Cp	n/a	5	Aspen Leading Mixedwood >> White Spruce
		CD, Cd. Cp	CD, Cd, Cp	Cd, Cp	Cp	Cp	n/a	6	White Spruce >> White Spruce
Static	OR uPXSBLT > 40%	DC					n/a	9	Deciduous-Pine-Black Spruce
		CD					n/a	8	Pine-Black Spruce-Deciduous
		C					tPX>= 80%	7	Pine
							tSW+tFB >= 20% and tPX >= tSB+tLT	10	Pine-White Spruce

MODEL TYPE	LEVEL 1 CRITERION (2)	(3) LEVEL 2 CRITERION						(4) LEVEL 3 CRITERION	(5) PATHWAY	
		0 – 29 yrs.	30 – 69 yrs.	70 – 109 yrs.	110 – 149 yrs.	Seral Stage 5	150+ yrs.		No.	Label
								tSW+tFB < 20% OR tSW+tFB >= 20% and tPX < tSB+tLT	12	Black Spruce-White Spruce
								tSB+tLT >= 80%	13	Black Spruce

PXSBLT*: The total overstory tree species composition (to the nearest 10 percent) of aggregated pine species (PX), black spruce (SB) and larch (LT).* ***uPXSBLT****: The total understory tree species composition (to the nearest 10 percent) of aggregated pine, black spruce and larch.*

*.'****Cp'*** *and* ***'Cd'*** *coverstates represented a further stratification of the 'C' coverstate, which was used exclusively in the static based stratification.* ***Cp*** *= 100% of the overstory trees are coniferous species.* ***Cd*** *= 80 to 99% of the overstory trees are coniferous species.* ***Du1****: At least 80% of the overstory trees are deciduous species and at least 'A' density coniferous tree species in the understory that are between 3 and 6 meters of the overstory height.* ***Du2****: At least 80% of the overstory trees are deciduous species and at least 'A' density coniferous tree species in the understory that are between 6 and 9 meters of the overstory height.* ***Du3****: At least 80% of the overstory trees are deciduous species and at least 'A' density coniferous tree species in the understory that are greater than 9 meters of the overstory height.*
tPX *= the total proportion of pine species in the combined overstory and understory*

tSB *= the total proportion of black spruce in the combined overstory and understory*

tLT *= the total proportion of larch in the combined overstory and understory*

tSW *= the total proportion of white spruce in the combined overstory and understory*

tFB *= the total proportion of balsam fir in the combined overstory and understory*

11 FOREST STRATIFICATION – WEST FMA

11.1 GENERAL PROCESS

The following input components are brought together in one MS-Access file - **west *forest stratify august2011.accdb*:**

AVI (STAND DATA, OSCOVER, USCOVER, STANDPOLY)
Composite Spatial (Composite Forest Westt)
Yield Information (VI_STRATA)
Cutover Information (blk_details, CUTOVER SUMMARY)
Preschedule (WEST PREBLOCK)
Cost Information (HAUL COSTS)

The accdb file also contains a number of utility tables used in the process and there are template tables. These tables hold the structure and metadata for input and output tables. The input tables are copied into templates to attach the field metadata – this makes the entire process from corporate dataset to finished submission one seamless process without manual data documentation steps.

The final output tables for use in TSA and other processes use templates in the same manner. The first step in the process deletes all records in the templates. The input data is copied into templates. Calculated fields and newly created fields are written to the output templates only. The input data never changes. As a last step, the work space table records are copied into a final output template. Only the final output tables are physically copied out of the accdb to be taken elsewhere for use (ie placed into a shapefile for use in Woodstock).

11.2 USE OF WEST FOREST STRATIFY AUGUST2011.ACCDB

The MS-Access file ***west forest stratify august2011.accdb*** is shipped without templates populated. The process needs to be run to view the output. The following steps should be taken:

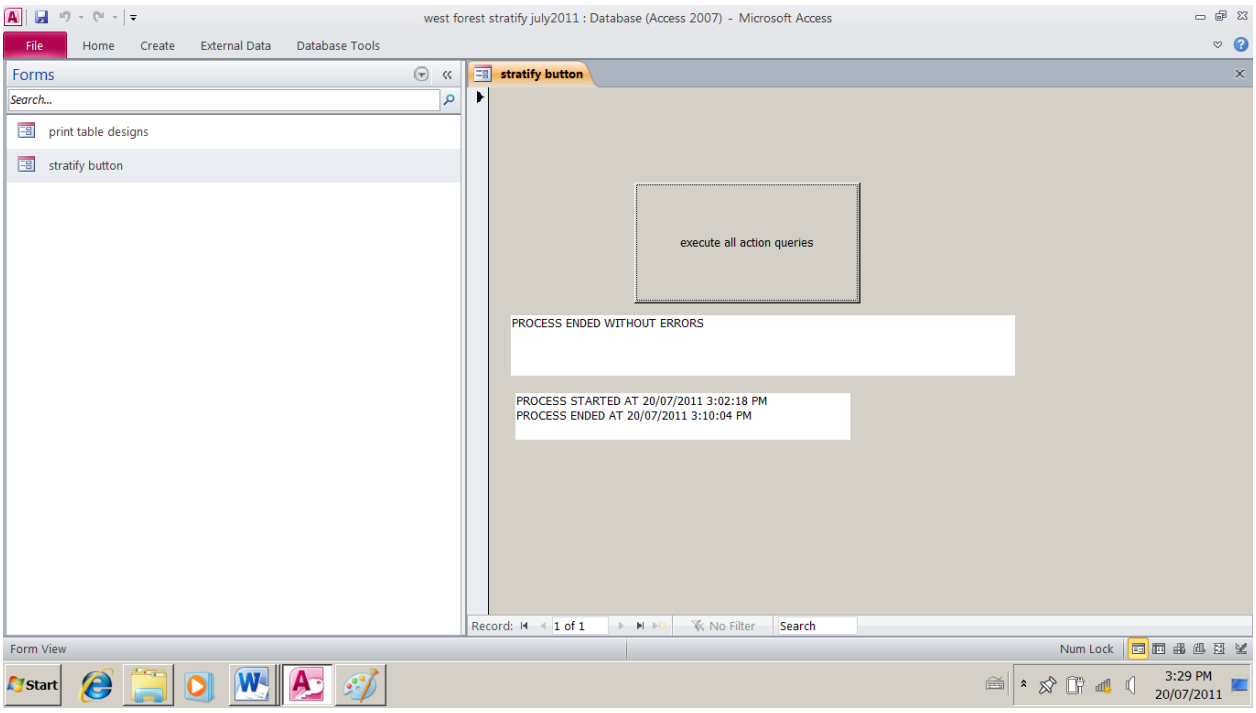
Execute the following action queries:

INITIALIZE00 DELETE tempFLATTABLE RECORDS
INITIALIZE01 DUMP tempCOMPOSITE FOREST RECORDS
INITIALIZE02 DELETE tempMODEL FOREST RECORDS
INITIALIZE03 DELETE out MODEL_FOREST RECORDS

Physically delete the table ***X TEMP PREBLOCK LIST.***

Compact and Repair the database. (This will prevent the 2 GB ceiling errors. This is essential to prevent corruption of the file.)

Execute Step1 through Step44 – do not execute any out of sequence and do not skip any. Alternatively you may launch the form ***stratify button***. Click the button and all action queries will run as a batch. When complete your screen will show the following



The table descriptions of all tables used in the process are provided in Table 11-1.

TABLE 11-1. TABLE DESCRIPTIONS FOR ALL TABLES USED IN FOREST STRATIFICATION.

Table Name	Table Description	Table Type
blk_details	DMI aspatial records from quota holders and various sources. June 15, 2011	Input
HAUL_COSTS	Haul costs for each AVI polygon based on NW AB Quarter Section cost surface 2009. $2 cost zones for theme6 calculated to	Input

	appropriate mill by fmu	
in COMPOSITE FOREST WEST	input TABLE "COMPOSITE FOREST WEST": This is a direct copy from the attribute table in the geodatabase. April 28, 2011	Input
in CUTOVER SUMMARY	CUTOVER SUMMARY Table from the cutover stratification step. Contains the results of many decision steps that will be used to assign yield, age, and landbase to cutovers in the composite forest..	Input
in DECLARED STRATA	The table “DECLARED STRATA” is used to assign a strata to blocks based on ARIS declaration	Input
in OSCOVER	The table “oscover” contains overstory information from the AVI. Mar 2, 2011	Input
in STAND DATA	The table “STAND DATA” uses information from the understory and overstory tables of the AVI to calculate the overstory and understory broad cover groups and the landbase call, taking into consideration the FMU. From March2, 2011 AVI	Input
in STANDPOLY	DMI VI system internal file linking forest key to ORACLE standpoly unique identifier. avi dump Mar 2, 2011	Input
in USCOVER	The table “uscover” contains understory information from the AVI. Mar 2, 2011	Input
in VI_STRATA	Stratification of all VI polys done at time of yield curve compile. Documentation in yield curve document. AVI dump Mar 2, 2011	Input

In WEST PREBLOCK	Aspatial preblocks from DMI, Canfor, Zavisha for east fma April 14, 2010. Assumes 10yr periods	Input
OSTORY_MOD1_ATT	Ostory mod1 table from AVI Mar 2, 2011. Not used in this DFMP submission	Input
OSTORY_MOD2_ATT	Ostory Mod2 table from AVI Mar 2, 2011. Not used in this DFMP.	Input
out MODEL_FOREST	Output table MODEL_FOREST: the results of the stratification process that goes into the wood supply model. This is the composite forest spatial with assigned attributes from all sources. THIS IS THE ASPATIAL PRODUCT UPON WHICH ALL TSA WORK IS COMPLETED.	Output
Qry_list	Query list used to automate the stratification steps	Utility
SUM3_Lookup	Lookup table for YC and Landbase types based on Broad Cover Group	Utility
temp COMPOSITE FOREST	Template COMPOSITE FOREST: Contains all the spatial information from the creation of the composite forest coverage. THIS IS THE SPATIAL PRODUCT UPON WHICH ALL MODELING IS BUILT	Work space
temp FLATTABLE	Template FLATTABLE - CONTAINS ALL INPUT INFORMATION FOR THE CREATION OF THE NET LANDBASE	Work space

temp MODEL_FOREST	Template MODEL_FOREST: The template and depository for all net landbase calculations. A spatial copy of the composite forest used as a 'scratch pad' during stratification.	Work space
utilPATHWAY LABELS	Utility table PATHWAY LABELS: Used for labelling Yield Curve Pathways in reporting	Utility
utilSORT ORDER BUFFERS	Utility table SORT ORDER BUFFERS: Used for sorting and labelling buffers in the net landbase summary tables	Utility
utilSORT ORDER DELETIONS	Utility table SORT ORDER DELETIONS: Used for sorting and labelling deletions in the net landbase summary tables	Utility
utilSORT ORDER LAND USE	Utility table SORT ORDER LAND USE: Used for labelling land use disturbances in the net landbase summary tables	Utility
utilSORT ORDER LANDBASE	Utility table SORT ORDER LANDBASE: Used for sorting and labelling landbases in the net landbase summary tables	Utility
utilSORT ORDER NONFOR	Utility table SORT ORDER NONFOR: Used for labelling non forested stands in the net landbase summary tables	Utility

11.3 STRATIFICATION STEPS

The following sections describe each individual action query that comprise the stratification steps. The descriptions are intended to guide the reviewer through the queries while looking at the MS-Access file.

11.3.1 INITIALIZE00 DELETE TEMP FLATTABLE RECORDS

General Description:

Delete all records from the temp FLATTABLE. Leaves a blank template without deleting documentation.

11.3.2 INITIALIZE01 DUMP TEMPCOMPOSITE FOREST RECORDS

General Description:

Delete all records from the tempCOMPOSITE FOREST RECORDS. Leaves a blank template without deleting documentation.

11.3.3 INITIALIZE02 DELETE TEMPMODEL FOREST RECORDS

General Description:

Delete all records from the tempMODEL FOREST table. Leaves a blank template without deleting documentation. This template is the main work space for the stratification process.

11.3.4 INITIALIZE03 DELETE OUT MODEL FOREST RECORDS

General Description:

Delete all records from the template out MODEL FOREST table. Leaves a blank template without deleting documentation. This template is where the final output is copied to for transfer to the TSA model.

11.3.5 STEP01 POPULATE TEMPCOMPOSITE FOREST WITH WEST

General Description:

The composite forest attribute table is copied into the template so that the fields are documented.

Details:

AREAHA field is calculated from the Shape_Area field which is by default stored in m^2.

The LANDUSE_FLAG field is set to 1 if the composite forest LUCLASS field has an entry; and set to 0 if LUCLASS has no entry.

11.3.6 STEP02 POPULATE TEMP MODEL FOREST

General Description:

Required items from the composite attribute table and the AVI stand data are copied into the work space.

Relates:

The composite polygon records are linked to the AVI STAND DATA table on the POLYID item. This is a one-to-many relate because each original AVI stand has been split into many composite forest polygons.

Details:

The field CONTRIBUTE is initialized with a dummy value

The field THEME3 is initialized with a dummy value

11.3.7 STEP03 FIX IRTAG SLIVERS

General Description:

During the composite forest creation, because of order of operations, some slivers were created that tagged slivers within Indian Reserves as being inside the FMA. This step cleans this by flagging those slivers as appropriately being outside the FMA and NOT contributing to the net land base.

Details:

For all records where (FMAFLAG is set to 1) AND (IRTAG field contains a valid entry):

Set FMAFLAG to 0
Set CONTRIBUTE FLAG to 0

11.3.8 STEP04 ASSIGN YIELD CURVES TO ALL AVI STANDS

General Description:

All stands are assigned the yield curves from the 2011 yield curve process based on the untouched AVI calls. This represents the default stratification. Subsequent steps will overwrite fields as appropriate.

Details:

The THEME1 field is set to the pathway number – this is the yield curve to be used in the TSA.

The field THEME3 is set to “Nat” (means natural forest) for TSA purposes

MODEL LANDBASE is set to the calculated landbase field value from STAND DATA. This represents the ownership of rights for a given stand.

Assigned Pathway is set to the pathway number

Pathway is set to the pathway number

Path Label is set to the tyextual description of the pathway number

11.3.9 STEP05 ASSIGN AGES TO ALL AVI STANDS

General Description:

This step assigns default ages to all AVI stands that have an origin (ie forested polygons).

Details:

Age at time of inventory = AVI reference year – AVI overstory origin
Age in years = 2009 – Stand Data Origin
Age in 5 year periods = Int(((Age in years)/5))+1
Age in 10 year periods = Int(((Age in years)/10))+1

The field STRATIFICATION TYPE is set to “Default AVI” to leave a permanent record of how each polygon received its final modeling stratifications.

11.3.10 STEP06 STRATIFY NON FOREST

General Description:

This step pulls a recordset of polygons that have a “non-treed” call in the STAND DATA table. Each of these records is then assigned appropriate values in the modeling fields.

Details:

The field STRATIFICATION TYPE is set to “AVI NON-TREED”
All age related fields are set to 0
The TSA model themes are set to non-modeled values.
The CONTRIBUTE field is set to 0.
The Species Group field is set to “non-treed”
The THEME3 field is set to “OTHER”
The Model Landbase Field is set to a shortened grouping of AVI non-forest categories from the table utilSORT ORDER NONFOR. The following table explains the rules applied. The simplified category assigned is used to simplify the model formulation and for simple reporting.

Non-Forest Detailed AVI Code	Shortened Code	Short Code Meaning
nonfor	group2	
A	VA	Vegetated Anthropogenic
BR	VN	Vegetated Naturally
GR	NA	Non-Vegetated Anthropogenic
HF	VN	Vegetated Naturally
HG	VN	Vegetated Naturally
IC	NA	Non-Vegetated Anthropogenic
IF	NA	Non-Vegetated Anthropogenic
IG	NA	Non-Vegetated Anthropogenic
IH	NA	Non-Vegetated Anthropogenic
II	NA	Non-Vegetated Anthropogenic
IP	VA	Vegetated Anthropogenic
IW	VA	Vegetated Anthropogenic
MB	NN	Naturally Non-Vegetated
MC	NN	Naturally Non-Vegetated
MR	NN	Naturally Non-Vegetated
MS	NN	Naturally Non-Vegetated
P	VA	Vegetated Anthropogenic
SC	VN	Vegetated Naturally
SO	VN	Vegetated Naturally

Non-Forest Detailed AVI Code	Shortened Code	Short Code Meaning
SR	NA	Non-Vegetated Anthropogenic
WF	NN	Naturally Non-Vegetated
WL	NN	Naturally Non-Vegetated
WR	NN	Naturally Non-Vegetated

11.3.11 STEP07 BRING IN CUTS, ASSIGNED YC, ASSIGNED AGE

General Description:

This step brings in the cutovers that have been tagged as having an assigned yield curve and an assigned age from the cutover update process. Those values overwrite the appropriate fields in the work space.

Details:

THEME1 is set to the assigned pathway from the cutover summary
ASSIGNED PATHWAY is copied from the cutover summary to maintain a permanent record of the overwite
AGE(YEARS) is set to the assigned age from the cutover summary.
AGE(5) is calculated from the assigned age from the cutover summary.
AGE(10) is calculated from the assigned age from the cutover summary.
STRATIFICATION TYPE is set to “CUT ASSIGNED YC ASSIGNED AGE” to maintain a permanent record of how the polygon was stratified.
CONTRIBUTE is set to 1 to indicate that the poly contributes to the net land base.
THEME3 is set to “Man” so the TSA may know that this is a managed stand.

This step (all cutover stratification steps) overwrites whatever was previously there in the work space fields affected. By doing so, we are giving the spatial cutover information priority over the default AVI. Slivers created into non-forested AVI polygons for example, are assigned yield curves and ages. We are effectively saying that the cutover information is better than the AVI and acting accordingly. This enables us to stratify ‘on-the’fly’ without completing hugely time-consuming manual sliver reductions. This in-turn, allows rapid compilation of strategic datasets.

STEP08 BRING IN CUTS, AVI YC, ASSIGNED AGE

General Description:

This step brings in the cutovers that have been tagged as having an assigned age and flagged to be stratified based on the AVI call from the cutover update process. Those values overwrite the appropriate fields in the work space.

Details:

This step pulls a recordset containing all composite polys that have a valid entry in the cutover summary assigned age field AND is flagged in the cutover summary calculated AVI flag field.

THEME1 is left alone – it has already been assigned the AVI stratification in a previous step.
ASSIGNED PATHWAY is set to the THEME1 recorded in the work space TEMP MODEl FOREST to maintain a permanent record of the assignment.
AGE(YEARS) is set to the assigned age from the cutover summary.
AGE(5) is calculated from the assigned age from the cutover summary.
AGE(10) is calculated from the assigned age from the cutover summary.
STRATIFICATION TYPE is set to “CUT AVI YC ASSIGNED AGE” to maintain a permanent record of how the polygon was stratified.
CONTRIBUTE is set to 1 to indicate that the poly contributes to the net land base.
THEME3 is set to “Man” so the TSA may know that this is a managed stand.

11.3.12 STEP09 BRING IN CUTS, AVI YC, AVI AGE

General Description:

This step brings in the cutovers that:

Have been flagged to be stratified using the AVI call
Have been flagged to be aged using the AVI call
Are not post08 preblocks

The query updates four fields to record the assignments.

Details:

This step pulls a recordset containing all composite polys that were flagged in the cutover summary process to be modeled on AVI stratification and AVI age AND are not preblocks.

THEME1 is left alone – it has already been assigned the AVI stratification in a previous step.
ASSIGNED PATHWAY is set to the THEME1 recorded in the work space TEMP MODEl FOREST to maintain a permanent record of the assignment.

The age fields are left alone because a previous step has already calculated them for these polys.
STRATIFICATION TYPE is set to “CUT AVI YC AVI AGE” to maintain a permanent record of how the polygon was stratified.
CONTRIBUTE is set to 1 to indicate that the poly contributes to the net land base.
THEME3 is set to “Man” so the TSA may know that this is a managed stand.

11.3.13 STEP10 BRING IN CUTS ASSIGNED YC, AVI AGE

General Description:

This step brings in the cutovers that have been tagged as having an assigned yield curve and flagged to use AVI for age from the cutover update process. Those values overwrite the appropriate fields in the work space.

Details:

THEME1 is set to the assigned pathway from the cutover summary
ASSIGNED PATHWAY is copied from the cutover summary to maintain a permanent record of the overwite
The age fields are left alone because a previous step has already calculated them for these polys
STRATIFICATION TYPE is set to “CUT ASSIGNED YC AVI AGE” to maintain a permanent record of how the polygon was stratified.
CONTRIBUTE is set to 1 to indicate that the poly contributes to the net land base.
THEME3 is set to “Man” so the TSA may know that this is a managed stand.

11.3.14 STEP11 ASSIGN POST91 CUT LBASE

General Description:

This step pulls a recordset containing all post91 cut composite polygons that contain a valid entry in the cutover summary assigned land base field. The value from that field overwrites the entry in TEMP MODEL FOREST.

MODEL LANDBASE is set to the value of assigned land base from the cutover summary

11.3.15 .STEP12 RETENTION

General Description:

This step pulls a recordset containing all composite polygons that contain a valid retention code in the block class field in cutover summary. Four fields are updated.

THEME1 is left alone – it has already been assigned the AVI stratification in a previous step.
ASSIGNED PATHWAY is set to the THEME1 recorded in the work space TEMP MODEl FOREST to maintain a permanent record of the assignment.

The age fields are left alone because a previous step has already calculated them for these polys.
STRATIFICATION TYPE is set to “RETENTION” to maintain a permanent record of how the polygon was stratified.
CONTRIBUTE is set to 1 to indicate that the poly contributes to the net land base.
THEME3 is set to “RET” so the TSA may know that this is a retention stand that will need a lock-out.

11.3.16 STEP13 POST REF YEAR CC THEN BURN

General Description:

This step stratifies polygons that were harvested after AVI was collected and then burned. The age is reset to be based on the fire year. The yield curve (THEME1) is not changed because the ARIS records reflect the proper declarations following fire and those declarations were used to assign yield curve.

Details:

The query pulls a recordset that contains all composite polys where:

The AVI reference year is less than the skid year (ie harvested after AVI collection)
The skid year is less than the fire year (ie the burn happened after the cut)
It is a post91 cut
There is a valid fire year entry

The following updates are made:

THEME1 is left alone – it has already been assigned stratification in a previous step.
ASSIGNED PATHWAY is set to the THEME1 recorded in the work space TEMP MODEl FOREST to maintain a permanent record of the assignment.
AGE(YEARS) is set to 2009 – fire year.
AGE(5) is calculated from AGE(YEARS)
AGE(10) is calculated from AGE(YEARS)
STRATIFICATION TYPE is set to “ref-cc-burn“ to maintain a permanent record of how the polygon was stratified.
CONTRIBUTE is set to 0 to indicate that the poly does not contribute to the net land base.
DELETION is set to “BURN”
THEME3 is set to “Burn” so the TSA may know that this is a burned stand.

11.3.17 STEP14 POST AVI BURN NON CUTOVERS

General Description:

This step updates non-cut, forested areas that have burned since AVI collection. The polygons are assigned whatever yield curve was there before fire and assigned age based on fire year. They are tagged as deletions and removed from the contributing landbase.

Details:

This query returns a recordset containing all composite forest polys where:

[(It is not a post 91 block) AND (it has burned since AVI collection) AND (it is a forested polygon)] OR [(it is a forested retention patch in a post 91 block) AND (it has burned since AVI collection)]

The following updates are made:

THEME1 is left alone – it has already been assigned stratification in a previous step.
Assumes the stand returns to pre-burn yield curve.
ASSIGNED PATHWAY is set to the THEME1 recorded in the work space TEMP MODEl FOREST to maintain a permanent record of the assignment.
AGE(YEARS) is set to 2009 – fire year.
AGE(5) is calculated from AGE(YEARS)
AGE(10) is calculated from AGE(YEARS)
STRATIFICATION TYPE is set to “POST AVI BURN“ to maintain a permanent record of how the polygon was stratified.
CONTRIBUTE is set to 0 to indicate that the poly does not contribute to the net land base.
DELETION is set to “BURN”
THEME3 is set to “Burn” so the TSA may know that this is a burned stand.

11.3.18 STEP15 EMEND LANDBASE

General Description:

This step removes the EMEND research site from the contributing land base.

MODEL LANDBASE is set to “LE”
CONTRIBUTE is set to 0

11.3.19 STEP16 DELETIONS NO AVI STRATA

General Description:

This step deletes non-forested stands that have not otherwise yet been overwritten with assignments.

Details:

For all composite polygons that have not by this point been assigned a valid yield curve number in THEME1:

deletion is set to “NO STRAT”.
CONTRIBUTE is set to 0

11.3.20 STEP17 NO HARVEST RESERVATION

General Description:

There are 21 types of protective notations in place on both FMAs. They were examined to determine which ones permit harvesting (see Table 11-2)..

Table 11-2. List of land use protective notations showing whether harvesting is permitted.

PNT With Restrictions	Harvest Allowed?
CFS	No
EMEND	YES
MWMA	No
NIVMA	No
PNT020092	No
PNT040360	No
PNT050181	No
PNT080050	No
PNT950071	YES
PNT950172	No
PNT990009	No
PSP1990	No
PSP2005	YES
PSPGOV	No
REC840004	No
REC840008	No
REC890026	No
REC950006	No
TSP1999	YES

PNT With Restrictions	Harvest Allowed?
TSP2005	YES
WESBOGY	No

This step removes polygons associated with the no-harvest PNTs as denoted in the table.

For all composite forest polys where:

There is a valid entry in the reservation field AND that entry does not include one of the allowable harvest PNTs

Perform the following updates:

Deletion is set to "NO HARVEST”
RESERV_DEL FLAG is set to 1
CONTRIBUTE is set to 0

11.3.21 STEP18 DELETIONS SD

General Description:

This step updates records for subjective deletions.

TABLE 11-3. SUBJECTIVE DELETIONS.

First Species in Overstory	Is this part of a Cutover ?	TPR	Is this Retention?	Overstory CC	Understory CC	Is this part of a Pre91 block?
LT	NO					
LT	YES		YES			
LT	YES					Yes
	NO	U				
	YES	U	YES			
	NO Yes	U		A	NULL	YES

	YES			A	NULL	YES

There is a very simple set of subjective deletions. Table 11-3 presents the conditions that must be met for a record to be subjectively deleted. If any one row of conditions is met, then the following updates are performed:

Deletion is set to “SD”
SD FLAG is set to 1.
CONTRIBUTE is set to 0.

11.3.22 STEP19 DELETIONS SB

General Description:

The yield curve stratification process contains a yield curve 13 for non-merchantable black spruce types. This step removes stands with yield curve 13 from the contributing landbase.

Details:

Deletion is set to “Sb”
CONTRIBUTE is set to 0.

11.3.23 STEP20 DELETIONS BREAKS

General Description:

This step removes steep slopes and incised valleys from the contributing landbase. Portions of known blocks falling within steep areas are ignored. The cutover linework is far more accurate than the rough strategic outline of incised valleys.

Details:

For all composite forest polys where:

(the incised valley layer says it is steep or incised) AND (it is not part of a cutblock)
Update the following:

deletion is set to “STEEP”

BREAKS FLAG is set to 1

CONTRIBUTE is set to 0

11.3.24 STEP21 DELETIONS NONFOREST

General Description:

This step deletes non-forested composite polys from the contributing landbase.

TABLE 11-4. NON FOREST CODES.

nonfor	label	group2
	Forested	
WL	Natural Non-Vegetated Water Lake	NN
WR	Natural Non-Vegetated Water River	NN
WF	Natural Non-Vegetated Water Flooded	NN
MC	Natural Non-Vegetated Mineral Cutbank	NN
MS	Natural Non-Vegetated Mineral Sand	NN
MB	Natural Non-Vegetated Mineral Burn	NN
MR	Natural Non-Vegetated Mineral Rock	NN
HF	Natural Vegetated Forbs	VN
HG	Natural Vegetated Grass	VN
BR	Natural Vegetated Moss	VN
SC	Natural Vegetated Closed Shrub	VN
SO	Natural Vegetated Open Shrub	VN
IH	Anthropogenic Non-Vegetated Industrial Right of Way	NA
IG	Anthropogenic Non-Vegetated Industrial Gravel	NA
II	Anthropogenic Non-Vegetated Industrial Millsite	NA
SR	Anthropogenic Non-Vegetated Ribbon Development	NA
IF	Anthropogenic Non-Vegetated Farmstead	NA
P	Anthropogenic Vegetated Perennial Crops	VA
A	Anthropogenic Vegetated Annual Crops	VA
IW	Anthropogenic Vegetated Wellsite	VA
IP	Anthropogenic Vegetated Right of Way	VA

GR	Anthropogenic Non-Vegetated Grazing	NA

Details:

For all composite forest polygons where:

(there is an AVI nonforest call and it is not part of a cutblock) OR (there is an AVI non forest call on a retention patch)

Update the following:

Deletion is set to “NONFOREST”
MODEL LANDBASE is set to group2 in Table 11-4 above.
CONTRIBUTE is set to 0.

STEP22 DELETIONS LAND USE

General Description:

This step updates composite forest polys with land use depletions.

Any composite poly that had a valid entry in the land use field has been flagged as being deleted due to removal for other land use.

Details:

For all composite forest polys where:

(LAND USE DEL FLAG is set to 1)
Update the following:

Deletion is set to “LAND USE”
CONTRIBUTE is set to 0.
THEME3 is set to “LINEAR”
THEME1 is set to 0
AGE(YEARS) is set to 0
AGE(5) is set to 0
AGE(10) is set to 0

11.3.25 STEP23 DELETIONS WATER BUFFER

General Description:

For all composite forest polys where:

(there is an entry in the HYDROBUF field from the composite forest) AND (it is not a presequenced block) AND (it is not a Post91 Cutover) AND it is not the actual lake/river body itself: (ie only the dry land portion of the area within the buffer gets tagged here – the water portion deletion takes priority in the order of deletions so we do not overwrite that in this step.)

Do the following Update:

Deletion is set to the value in HYDROBUF to record what type of buffer it is
WATER BUFFER FLAG is set to 1 to permanently record that this poly is in a buffer
CONTRIBUTE is set to 0.
THEME3 is set to “OTHER”

11.3.26 STEP24 DELETIONS NON FMA

General Description:

This step deletes composite forest polys that are outside the FMAs.

Details:

If the FMA Flag is 0 (ie if the poly is outside the FMAs) then:

Deletion is set to “NONFMA”
CONTRIBUTE is set to 0.
THEME3 is set to “OTHER”

11.3.27 STEP25 DELETIONS PRIVATE

General Description:

This step deletes composite forest polys that are within private land

Details:

If the Private Flag is 1 (ie if the poly is within private land) then:

Deletion is set to “PRIVATE”
CONTRIBUTE is set to 0.
THEME3 is set to “OTHER”

11.3.28 STEP26 DELETIONS IR/SETTLEMENTS

General Description:

This step deletes composite forest polys that are inside Indian Reserves.

Details:

If the IRTAG field contains a valid code for an Indian Reserve then:

Deletion is set to “IR”
CONTRIBUTE is set to 0.
THEME3 is set to “OTHER”

11.3.29 STEP27 CONTRIBUTING NATURAL FOREST

General Description:

This step assigns polys (not yet assigned to the contributing landbase) with natural AVI stratification to the contributing landbase.

Details:

For all composite forest polys that:

Have not yet been added to the contributing landbase and;
Were stratified by the default AVI step and;
Have a yield curve 1-12 and
Is not steep and is not below breaks and
Is inside the FMA and;
Is not a land use deletion and;
Is not in a water buffer and;
Is a forested stand.
Update the following:

CONTRIBUTE is set to 1.

11.3.30 STEP28 CLEAN PLAN SLIVERS ON PRE91 CUTS

General Description:

There are planned cutblocks adjacent to very old Pre91 blocks. The slivers entering onto the old blocks are more appropriately to be identified with the new planned block as that is the more accurate data. This step overrides previous steps and makes sure that the entire GPS block from the field is represented in the model as contributing landbase.

Details:

For all composite forest polys that:

Have not yet been added to the contributing landbase and;
Are in the cut portion of a Pre91 block and ;
Are inside a planned block and ;
Have a yield curve 1-12 and
Are inside the FMA and;

Are not a land use deletion and;
Are not in a water buffer and;
Are in a forested AVI stand.
Update the following:

CONTRIBUTE is set to 1.

11.3.31 STEP29 CLEAN SLIVERS PRE91 ALONG BREAKS

General Description:

The breaks flag is a strategic estimate that is included to capture the larger scale impact of not harvesting in incised valleys. Where better quality data (ie cutover boundaries) conflict with the breaks estimate, the better quality data will take precedence. There are known old cutovers that partially cross the breaks lines to create slivers. This step overrides the breaks deletions for areas of known cutovers.

Details:

For all composite forest polys that:

Have not yet been added to the contributing landbase and;
Are in the cut portion of a Pre91 or Post08 block and ;
Are inside the breaks of incised valleys and ;
Have a yield curve 1-12 and
Are inside the FMA and;
Are not a land use deletion and;
Are not in a water buffer and;
Are in a forested AVI stand.
Update the following:

CONTRIBUTE is set to 1.

11.3.32 STEP30ASSIGN DELETIONS TO THEME2

General Description:

This step begins to transfer information into the fields used by the timber supply model. All composite forest polys that are not in the contributing landbase are assigned a THEME3 of "OTHER".

11.3.33 STEP31 THEME2 EMEND

General Description:

For all composite forest polys with a model landbase assignment of "LE" (ie everything inside the EMEND site):

THEME2 is set to “LE”

11.3.34 STEP32 THEME2 SENSITIVE SITES

General Description:

This step assigns the value for THEME2 based on land base for composite polys that have been tagged as rugged in the steep slopes and incised valley layer.

Details:

For all composite forest polys that:

Have not yet been assigned a THEME2 entry and;
Are in the contributing land base and;
Are in either the deciduous or conifer landbase and;
Are coded as rugged terrain in the steep slopes and incised valleys layer
Update:
THEME2 is set to a concatenation of the value in Model Landbase with “SEN” (gives valid codes of LCSEN and LDSEN)

11.3.35 STEP33 THEME2 PRODUCTIVE SITES

General Description:

This step assigns the value for THEME2 based on land base for composite polys that are in the contributing landbase.

Details:

For all composite forest polys that:

Have not yet been assigned a THEME2 entry and;
Are in the contributing land base and;
Are in either the deciduous or conifer landbase;
Update:
THEME2 is set to a concatenation of the value in Model Landbase with “IN” (gives valid codes of LCIN and LDIN)

11.3.36 STEP34 THEME4 FMU

General Description:

This step copies the FMU field values into the THEME4 field.

11.3.37 STEP35 THEME5 PINE BEETLE

General Description:

In 2008, the Alberta Government calculated the mountain beetle susceptibility ratings. This value is updated to “zz” as a placeholder until updated susceptibility ratings are provided. The final forecasting document will provide details.

11.3.38 STEP36 REMOVALS

General Description:

Post08 block removals are assigned a landbase and stratification type. These are portions of blocks that have been removed during the layout phase.

Details:

For all composite forest polys that:

Are inside a Post08 blocks and;
Have been assigned a flag meaning non-forest (yield curve = -1)
Update:

CUT PERIOD is set to 0
CONTRIBUTE is set to 0
ACTION is set to 0
PREBLOCK is set to null
All age fields are set to 0
THEME1 is set to 0
THEME2 and THEME3 are set to “OTHER”

11.3.39 STEP37 PREBLOCK POST08 SPATIAL CUTS

General Description:

The CUTOVER SUMMARY table contains spatial preblocks to be harvested in 2009 and 2010. These are from GPS layout and are brought forward here to ensure that the TSA is forced to harvest them in the first period. This step populates the THEME values to do that.

Details:

For all composite forest polys that:

Are inside a Post08 blocks and;
Are not already tagged as a deletion in the TSA THEME2 field AND
Have been flagged with a harvest moniker (Assigned Treatment = 1)
Update:

CUT PERIOD is set to 1
ACTION is set to 1
PREBLOCK is set to “YES”

11.3.40 STEP38 PREQUERY

General Description:

Much of the harvest sequence was manually selected from the AVI map. Entire AVI stands were built into the in WEST PREBLOCK table. This step and the next one nets down the selected blocks to include only the portions of the selected stands that meet TSA operability.

This selection query pulls a recordset of composite forest polys for which there is an aspatial preblock while dropping any polys already flagged as deletions or under 30 years of age.

11.3.41 STEP38 PREQUERY2

General Description:

This selection query makes a list of all composite forest polys that are in a Post08 block.

11.3.42 STEP38 MAKE X TEMP PREBLOCK LIST

General Description:

This query uses the previous two prequeries. It returns a list of composite forest polys that are present in the preblocks list that are not present in the Post08 blocks list. The resultant answer is written to the table X TEMP PREBLOCK LIST.

This step removes duplication and overlap between the Post08 blocks and the newer list of hand picked preschedules.

11.3.43 STEP39 ASPATIAL PREBLOCKS

General Description:

Ten years of preblocks have been preselected. The table X TEMP PREBLOCK LIST is a cleaned list of composite polygons to be included in the preschedule. This step incorporates the preschedule.

The CUTOVER SUMMARY table contains spatial preblocks to be harvested in 2009 and 2010. These are from GPS layout and are brought forward here to ensure that the TSA is forced to harvest them in the first period. This step populates the THEME values to do that.

Details:

For each composite forest poly in the X Temp Preblocks list, Update:

PREBLOCK is set to “YES”
ACTION is set to 1
CUT PERIOD is set to the period specified by the forest planner when building the preschedule table.
OPER is set to the company name that selected the block for preschedule.

11.3.44 STEP40THEME6 COST ZONES

General Description:

The TSA incorporates cost zones. The cost surface is calculated in an external process that will be described fully in the Forecasting documentation. The costs are copied here from the table HAUL_COSTS to THEME6.

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11.3.45 STEP41 APPEND TEMP MODEL_FOREST TO OUT MODEL_FOREST

General Description:

This query copies all fields from the work space table temp MODEL FOREST to the output table out MODEL_FOREST. At this stage, the stratification is complete. out MODEL FOREST will now be used in the TSA model creation.

11.3.46 STEP42 MAKE FLAT FILE

General Description:

This step creates a flat file containing all decision making fields and all output fields used during the forest stratification.

11.3.47 STEP43 DELETE TEMP MODEL_FOREST RECORDS

General Description:

This query deletes all records from the work space table temp MODEL FOREST.

11.3.48 STEP44 DELETE TEMPCOMPOSITE RECORDS

General Description:

This query deletes all records from the temp COMPOSITE table.

11.4 TABLE DEFINITIONS

TABLE 11-5. TABLE DEFINITIONS FOR ALL TABLES USED IN THE FOREST STRATIFICATION PROCESSING STEP.

Table Name	Field Name	Data Type	Field Description
blk_details	OBJECTID	Double	Internal sequence number generated by geodatabase
	BLK_DET_ID	Double	BLOCK DETAILS IDENTIFIER: Unique key. Each record represents one opening record from ARIS
	OPEN_NUM	Text	ARIS OPENING NUMBER: ARIS opening number if known
	FMU	Text	FOREST MANAGEMENT UNIT: Based on historical records provided by operator.
	ARIS_FMU	Text	ARIS Forest Management Unit Code
	DISP_TYPE	Text	DISPOSITION TYPE: Forest Tenure disposition type under which cut was performed
	OP_AREA	Text	OPERATING AREA: License area before 2008. DMI Operating Area after 2009
	BLOCK_ID	Text	BLOCK IDENTIFIER: Annual Operating Plan Block Number
	SKID_DATE	Date/Time	ARIS SKID DATE: Date the block was skid cleared
	SKID_TYEAR	Double	SKID TIMBER YEAR: The timber year the block was skid cleared. (Timber years are May 1 to April 30)
	LBASE_CODE	Text	ARIS LANDBASE CODE: 2 character code explaining the "from lbase" and the "to lbase"
	REGEN_CODE	Text	ARIS REGENERATION DECLARATION CODE: Regen

Table Name	Field Name	Data Type	Field Description
			standard declared for the block
	HARV_AREA_HA	Double	ARIS DECLARED HARVEST AREA: Harvest area declared in hectares
	CON_VOL_M3	Double	CONIFER VOLUME: Reported harvest volume of Conifer in DMI blocks if known
	DEC_VOL_M3	Double	DECIDUOUS VOLUME: Reported harvest volume of Deciduous in DMI blocks if known
	HARV_STAT	Text	HARVEST STATUS: null = No ARIS record match(probably has been harvested) ; Cut = has been harvested; Plan = Layed out but not harvested yet
	SOURCE	Text	SOURCE: Information source for this record: Operator supplied
	SOURCE_BLK_NUM	Text	SOURCE_BLK_NUM:DMI internal flag
	CUTB_SEQ_NBR	Double	CUTBLOCK SEQUENCE NUMBER: DMI internal sequence number to link to GENUS records
	DISPBLK	Text	DISPOSITION BLOCK:AOP Disposition-Block Number
	SURV_TYPE	Text	SURVEY TYPE: Most Recent Regen Survey Type: Null = none; EST SURVEY = Establishment Survey; PER Survey = Performance Survey
	STOCK_STAT	Text	STOCKING STATUS:ARIS Regen standards stocking status
	TOT_STOCK	Double	TOTAL STOCKING: % Stocking of latest survey if one exists
	RETREAT	Text	RETREAT: Indicates Intent to retreat: Internal ARIS Flag.

Table Name	Field Name	Data Type	Field Description
	OP_REF_RES	Text	OPERATOR REFORESTATION RESPONSIBILITY: ARIS operator code for company holding liability
	BLK_UPD_NON_RET_AREA_HA	Double	Area of cut portions (non-retention) of blocks, in ha
in COMPOSITE FOREST EAST	all fields		This is an autogenerated table and as such has no metadata - Look at temp Composite Forest for equivalent field descriptions.
in CUTOVER SUMMARY	BLOCKS_UK	Long	BLOCKS UNIQUE KEY: Unique identifier of input feature class BLOCKS
	BLK_DET_ID	Double	Unique identifier assigned to each record in the Blocks Details table
	OPEN_NUM	Text	ARIS Opening number
	DISPBLK	Text	Disposition Block:Concatenation of disposition and block number
	STOCK_STAT	Text	Stocking Status: null; CSR, FTG,NSR,RTD,SR
	SOURCE	Text	Source of cutblock information: <company>; MTU; FRIA
	OP_AREA	Text	Oerating Area = Cut disposition: License/compartment numbers, MOF flag
	BLOCK_ID	Text	Number assigned to block when harvested, if known. Only unique within a license within a timber year
	FMU	Text	Forest Management Unit: F1, P1S, P2, P3, P4, P5, P10, S15, P11, P1N
	ARIS_FMU	Text	ARIS FMU alphanumeric codes:

Table Name	Field Name	Data Type	Field Description
	DISP_TYPE	Text	Disposition Type: Type of disposition such as CTP, CTL, FMA, MOF, LTP. EMEND, FMA,
	SKID_DATE	Date/Time	Date that timber was skid-cleared
	SKID_YEAR	Double	The 4-digit timber-year that harvesting occurred in. If skid-cleared between May 02/1998 and May01/1999, then 1998 was used.
	SURV_TYPE	Text	Survey type conducted (Establishment or Performance): Est Survey; Per Survey
	LBASE_CODE	Text	Landbase code as per ARIS Industry Operations Manual, Appendix C - Domain Codes
	REGEN_CODE	Text	Regeneration code as per ARIS Industry Operations Manual, Appendix C - Domain Codes
	CON_VOL	Long	Conifer Harvest Volume if known
	DEC_VOL	Long	Deciduous Harvest Volume if known
	SOURCE_BLK_NUM	Text	Source Block Number: Block Numbers provided by source - not always valid
	CUTB_SEQ_NBR	Long	Cut Block Sequence Number: Source Provided Block 'number' alphanumeric code
	HARV_STAT	Text	Block status: Null;Cut; Planned; future
	AREA_HA	Double	Area in hectares
	BLK_STATUS	Text	BLOCK STATUS from BLOCKS feature class: CUT- block cut and photo confirmed, PLANNED - block laid out with GPS, FUTURE - future block, RET_INT - retention internal to block, RET_EXT - retention external to block

Table Name	Field Name	Data Type	Field Description
	BLK_SOURCE	Text	BLOCK SOURCE from BLOCKS feature class: Where did the spatial data come from? AVI_v1 = AVI 1989; GPS = layout; Plan = AOP planning; Update = photo update
	SHAPE_AREA	Long	Polygon (from BLOCKS feature class) area in meters squared
	HARV_YEAR	Long	HARVEST YEAR: DMI manual assignment of harvest year from many sources from BLOCKS feature class
	RETREAT	Text	ARIS flag for NSR CSR stands requiring retreatments
	OP_REF_RES	Text	OPERATOR with REFORESTATION RESPONSIBILITIES
	TOT_STOCK	Long	ARIS Total Stocking Percentage
	cPOST91	Long	CALCULATED POST91 FLAG: Is this record Post 91? Yes or No
	cPRE91	Long	PRE91 block? : 1 = yes, 0 = no
	cPOST08	Long	POST 2008 block?: 1 = yes, 0 = no
	cARIS_LINK	Long	CALCULATED ARIS LINK: Does this record have an ARIS Record? Yes or No
	cCUT_TYPE	Long	CALCULATED CUT TYPE: 1 - 8
	cARIS_AGE FLAG	Long	CALCULATED ARIS AGE FLAG: Does this record have an ARIS skid timber year? 1= yes; 0 = no
	cHARVEST YEAR FLAG	Long	CALCULATED HARVEST YEAR: DMI manual assignment of harvest year from many sources: 1 = yes; 0 = no
	cAVI AGE FLAG	Long	CALCULATED AVI AGE FLAG: Use AVI origin. 1 = yes; 0= no

Table Name	Field Name	Data Type	Field Description
	cAVI Strat FLAG	Long	CALCULATED AVI STRATIFICATION FLAG: 1 = yes; 0=no
	ASSIGNED YC	Long	ASSIGNED PATHWAY: G&Y 2009 valid pathways
	ASSIGNED AGE(YEARS)	Long	ASSIGNED AGE: Age(years) assigned by stratification routine
	ASSIGNED TREATMENT	Long	Assigned Treatment: For prescheduled blocks in Woodstock model. Harvest treatment code
	ASSIGNED TREATMENT YEAR	Long	Assigned Treatment year: For prescheduled blocks in Woodstock Model. Future harvest year if known.
	ASSIGNED LBASE	Text	Assigned Land Base based on strata declaration and FMU
in DECLARED STRATA	REGEN CODE	Text	Declared Stratum C, CD, DC, D
	ASSIGNED YC	Long	G&Y2008 PATHWAY
in OSCOVER	POLYID	Long	Unique standpoly id (smallest avi entity) in the ORACLE master database storing the AVI
	TWP	Long	Township
	RGE	Long	Range
	MER	Long	Meridian
	PID	Long	Polygon Identifier
	FORESTKEY	Text	Concatenated forestkey
	FMU	Text	Forest Management Unit
	MOISTURE	Text	Moisture Regime 'd' , 'a', 'w', 'm'

Table Name	Field Name	Data Type	Field Description
	CC	Text	Overstorey Crown Closure - 25% classes A, B, C, D
	HEIGHT	Long	1metre height class
	S1	Text	Species 1
	P1	Long	Percentage Crown Closure of Species 1 - 10% classes
	S2	Text	Species 2
	P2	Long	Percentage Crown Closure of Species 2 - 10% classes
	S3	Text	Species 3
	P3	Long	Percentage Crown Closure of Species 3 - 10% classes
	S4	Text	Species 4
	P4	Long	Percentage Crown Closure of Species 4 - 10% classes
	S5	Text	Species 5
	P5	Long	Percentage Crown Closure of Species 5 - 10% classes
	STRUCTURE	Text	Stand Structure Flag - M=multistory
	ORIGIN	Long	10 year Origin class
	TPR	Text	Timber Productivity Rating - U, F, M, G
	INTERTPR	Text	Interpreted TPR Flag
	NONFORTYPE	Text	Non-Forest Type - BR, HF, HG, SC, SO
	NONFORCL	Long	Non-Forest Shrub Closure - 10% Crown Closure Classes for SO & SC Nonfortypes

Table Name	Field Name	Data Type	Field Description
	ANTHVEG	Text	Anthropogenic Vegetated - A=Annual Crops; P=Perennial Crops; IP=Industrial Pipeline; IW=Wellsite; IU= Unknown Clearing
	ANTHNONVEG	Text	Anthropogenic Non Vegetated -IF, IG, IH, II, IW, SA, SR
	NATNONVEG	Text	Natural Non-Vegetated - MB, MC, MR, MS, WF, WL, WR
	intBCGRP	Long	Integer Broad Cover Group : 10% Crown Closure Class of Deciduous Species
	strBCGRP	Text	String Broad Cover Group - C, CD, DC, D
	AREAHA	Double	Area in Hectares from .PAT
	compflag	Text	Composite Flag - used in composite weighting scheme
	DELETION	Text	Deletion Flag
	NONFOREST	Text	NonForest Class - Concatenation of NONFORTYPE, ANTHVEG, ANTHNONVEG, NATNONVEG
	species group	Text	A Coarse Level classification of leading species
	REFYEAR	Long	Reference Year
	RETYEAR	Long	Retired Year
	RIS LBASE	Text	Landbase derived from composite weighting BCGRP - RIS codes
	LBASE	Text	Landbase derived from Over Storey only
in STAND DATA	POLYID	Long	Unique standpoly id (smallest avi entity) in the ORACLE master database storing the AVI

Table Name	Field Name	Data Type	Field Description
	TWP	Long	Township 82-103
	RGE	Long	Range 1-26
	MER	Long	Meridian 5-6
	PID	Long	Polygon Identifier: unique to an interpreted polygon within a township, from 1 to 9999
	FMU	Text	Forest Management Unit - f1,p1N, P1S,p2,p3,p4,p5,p10, P11,s15
	compflag	Text	composite weighting of the overstory and understory
	intBCGRP	Long	Integer Code for overstory Broad Cover Group
	strBCGRP	Text	Character Code for overstory Broad Cover Group
	intBCGRP_C	Long	Integer Code for Composite Broad Cover Group
	strBCGRP_C	Text	Character Code for Composite Broad Cover Group
	LEADSP	Text	Leading species - single most prevelant species percent
	HEIGHT	Long	Height in 1 m classes
	HT6M	Integer	Height in 6 m classes
	DENSITY	Text	Density Class A,B,C,D
	ORIGIN	Long	10 year origin class
	TPR	Text	Timber Productivity Rating U,F,G,M
	P3STRATA	Integer	OLD Phase3 strata
	SRC96STRATA	Integer	S/RC Yield Curve Strata
	ris89 stratum	Long	RIS department strata

Table Name	Field Name	Data Type	Field Description
	ris89 stratkey	Text	RIS department strata unique key
	RIS LBASE	Text	RIS Calculated Landbase
	OS_LBASE	Text	Overstory Landbase
	US_LBASE	Text	Understory Landbase
	CALC LBASE_O	Text	Calculated Landbase from overstory Broad Cover Group
	CALC LBASE	Text	Calculated Landbase from Composite Broad Cover Group
	DELETION	Text	Deletion Type
	NONFOREST	Text	Nonforest AVI Code
	species group	Text	Species Group: major species categories used for exploratory work
	COUNTER	Long	Used for Exploratory Work
	AREAHA	Double	Area (ha) of polygon
in STANDPOLY	PID	Long	Polygon Identifier: unique to an interpreted polygon within a township, from 1 to 9999
	MER	Long	Meridian 5-6
	TWP	Long	Township 82-103
	RGE	Long	Range 1-26
	POLYID	Double	Unique standpoly id (smallest avi entity) in the ORACLE master database storing the AVI
	STANDID	Double	IGNORE - internal stand id not used anymore
	AREAHA	Double	Area (ha) of polygon

Table Name	Field Name	Data Type	Field Description
	REPLACED_BY_PID	Long	Replaced by - VI internal
	RETYEAR	Long	Retirement Year
in USCOVER	POLYID	Long	Unique standpoly id (smallest avi entity) in the ORACLE master database storing the AVI
	TWP	Long	Township
	RGE	Long	Range
	MER	Long	Meridian
	PID	Long	Polygon Identifier
	FORESTKEY	Text	Concatenated forestkey
	FMU	Text	Forest Management Unit
	MOISTURE	Text	Moisture Regime 'd' , 'a', 'w', 'm'
	CC	Text	Overstorey Crown Closure - 25% classes A, B, C, D
	HEIGHT	Long	1metre height class
	S1	Text	Species 1
	P1	Long	Percentage Crown Closure of Species 1 - 10% classes
	S2	Text	Species 2
	P2	Long	Percentage Crown Closure of Species 2 - 10% classes
	S3	Text	Species 3
	P3	Long	Percentage Crown Closure of Species 3 - 10% classes
	S4	Text	Species 4

Table Name	Field Name	Data Type	Field Description
	P4	Long	Percentage Crown Closure of Species 4 - 10% classes
	S5	Text	Species 5
	P5	Long	Percentage Crown Closure of Species 5 - 10% classes
	STRUCTURE	Text	Stand Structure Flag - M=multistory
	ORIGIN	Long	10 year Origin class
	TPR	Text	Timber Productivity Rating - U, F, M, G
	INTERTPR	Text	Interpreted TPR Flag
	NONFORTYPE	Text	Non-Forest Type - BR, HF, HG, SC, SO
	NONFORCL	Long	Non-Forest Shrub Closure - 10% Crown Closure Classes for SO & SC Nonfortypes
	ANTHVEG	Text	Anthropogenic Vegetated - A=Annual Crops; P=Perrennial Crops; IP=Industrial Pipeline; IW=Wellsite; IU= Unknown Clearing
	ANTHNONVEG	Text	Anthropogenic Non Vegetated -IF, IG, IH, II, IW, SA, SR
	NATNONVEG	Text	Natural Non-Vegetated - MB, MC, MR, MS, WF, WL, WR
	intBCGRP	Long	Integer Broad Cover Group : 10% Crown Closure Class of Deciduous Species
	strBCGRP	Text	String Broad Cover Group - C, CD, DC, D
	AREAHA	Double	Area in Hectares from .PAT
	DELETION	Text	Deletion Flag
	NONFOREST	Text	NonForest Class - Concatenation of NONFORTYPE, ANTHVEG,

Table Name	Field Name	Data Type	Field Description
			ANTHNONVEG, NATNONVEG
	species group	Text	A Coarse Level classification of leading species
	REFYEAR	Long	Reference Year
	RETYEAR	Long	Retired Year
	RIS LBASE	Text	Landbase derived from composite weighting BCGRP - RIS CODES
	LBASE	Text	Landbase derived only from ustory records
in VI_STRATA	POLYID	Long	AVI Polygon Identifier (unique within each ats township)
	PATHWAY	Long	Yield Curve Pathway Number from 2011 Submission
	LABEL	Text	Descriptive Label for Yield Curve Pathway Number from 2011 Submission
	ORIGIN	Long	2011 adjusted origin
	REFAGE	Long	reference age (ie age on date photo was flown) used for regression in yc development
	PATHWAY_AGE	Long	age used in regression - (last full 10 years period fully achieved) eg 47 years old = currently in period 5 = age 40
	TWP	Long	Township
	RGE	Long	Range
	MER	Long	Meridian 5-6
	PID	Long	Polygon Identifier: unique to an interpreted polygon within a township, from 1 to 9999

Table Name	Field Name	Data Type	Field Description
SUM3_Lookup	Broad grouping	Text	Broad Cover Group: “Conifer” or “Deciduous”
	YC TYPE	Text	Yield Curve Type: “Empirical” or “Successional”
	THEME2	Text	Landbase type for Woodstock Input: LCIN, LCSEN, LDIN, LDSEN
HAUL_COSTS	FMU	Text	Forest Management Unit: F1, P1S, P2, P3, P4, P5, P10, S15, P11, P1N
	PID	Long	Polygon Identifier: unique to an interpreted polygon within a township, from 1 to 9999
	MER	Long	Meridian
	TWP	Long	Township
	RGE	Long	Range 1-26
	polyid	Double	Unique standpoly id (smallest avi entity) in the ORACLE master database storing the AVI
	BOUCHER	Single	Cost of haul to Boucher Bros. in Nampa
	BUCHANAN	Single	Cost of haul to Buchanan
	CANFOR	Single	Cost of haul to Canfor in Grande Prairie
	DMI	Single	Cost of haul to DMI in Peace Riv
	MANNING	Single	Cost of haul to MDFP in Manning
	TOLKO	Single	Cost of haul to Tolko in High Level
	ZAVISHA	Single	Cost of haul to Zavisha in Hines Creek
	cost2d_dec	Long	Haul cost of deciduous in $2 increments

Table Name	Field Name	Data Type	Field Description
	cost2d_con	Long	Haul cost of coniferous in $2 increments
	THEME6	Text	Theme: concatenation of "D" + [$2 cost] +"C" + [$2 cost]
in EAST PREBLOCK	OBJECTID	Double	Geodatabase internal sequence number
	OPER	Text	Operator: The company that selected this block for harvest in the first 20 years. DMI, Canfor, Zavisha
	STAND_POLY	Double	DMI VI internal identifier for AVI polygons: Mar. 2, 2011 avi dump
	STAT	Text	STATus of block: P=planned; G= GPS'd; null=new selection
	Area	Double	Area ha of the whole AVI stand
	Per	Double	PERiod: The 10 year period to force TSA to harvest in
out MODEL_FOREST	CMPKEY	Double	COMPOSITE FOREST KEY
	POLYID	Long	POLYGON ID : UNIQUE IDENTIFIER OF AVI SMALLEST ENTITY RECORD
	BLOCKS_UK	Double	unique key from 'IN cutover summary' ' (Master update table that pulls all sources of past and future cuts together) Actual cuts up to 2008 season
	CONTRIBUTE	Long	CONTRIBUTES TO THE NET LANDBASE (0, 1)
	strBCGRP_C	Text	Character Code for Composite Broad Cover Group
	RIS LBASE	Text	LBASE as calculated by RIS - Composite weighting scheme used
	STRATIFICATION TYPE	Text	Type of stratification method used to

Table Name	Field Name	Data Type	Field Description
			update cutblocks or fires.
	Assigned Pathway	Long	Yield Curve Stratum
	age at inventory	Long	age at ref year
	AGE (YEARS)	Long	AGE IN YEARS at time zero (May 1, 2009)
	AGE(5)	Long	AGE IN NUMBER OF 5 YEAR PERIODS on May1, 2009
	AGE(10)	Long	AGE IN NUMBER OF 10 YEAR PERIODS on May1, 2009
	CUT PERIOD	Long	5 year CUT PERIOD FOR MODEL PRESCHEDULE
	ACTION	Long	MODELED ACTION BEING PRESCHEDULED
	PREBLOCK	Text	PREBLOCK FLAG (Y or Null)
	THEME1	Text	Theme1 in Woodstock model - Reserved keyword
	THEME2	Text	Theme2 in Woodstock model - Reserved keyword
	THEME3	Text	Theme3 in Woodstock model - Reserved keyword
	THEME4	Text	Theme4 in Woodstock model - Reserved keyword
	THEME5	Text	Theme5 in Woodstock model - Reserved keyword
	THEME6	Text	Theme6 in Woodstock Model - Reserved Keyword
	SD FLAG	Long	SUBJECTIVE DELETION FLAG (0, 1)
	MODEL LANDBASE	Text	Landbase used in model LD,LC, LE, VA, VN, NN, NA (Calculated Landbase from Composite Broad Cover Group)

Table Name	Field Name	Data Type	Field Description
	GRAZING FLAG	Long	Grazing range flag as follows:0 - not within Grazing range1 - within Grazing range
	BREAKS FLAG	Long	SUBJECTIVE DELETION FOR LAND BELOW BREAKS AND STEEP SLOPES (0,1)
	FMA FLAG	Long	Inside FMA = 1; Deleted or Outside FMA = 0
	LAND USE DEL FLAG	Long	SEISMIC, PIPELINES,ETC (0,1)
	WATER_BUFFER FLAG	Long	WATER COURSE BUFFERS AS PER GROUND RULES (0,1)
	deletion	Text	Priority Deletion Type
	nonfor	Text	non forest
	RESERV_DEL FLAG	Long	Area with timber harvesting restriction (0,1)
	CALC LBASE	Text	Calculated Landbase from Composite Broad Cover Group
	FMU	Text	Forest Management Unit - f1,p1N, P1S,p2,p3,p4,p5,p10, P11,s15
	AREAHA	Double	AREA IN HECTARES
	TREEDAREAHA	Double	TREED AREA IN HECTARES
	CATCHKEY	Text	CATCHMENT KEY: IDENTIFIER OF WATERSHED
	PATHWAY	Long	PATHWAY ASSIGNED IN 2011 YIELD CURVE METHODOLOGY : 0 TO 13
	PATHLABEL	Text	TEXT LABEL DESCRIBING THE PATHWAY ASSIGNED IN 2011 YIELD CURVE METHODOLOGY
	STRATUM08	Text	HEIGHT DEPENDANT STAND/STOCK TABLE STRATUM FROM 2008 YIELD CURVE METHODOLOGY

Table Name	Field Name	Data Type	Field Description
	STRATUMLABEL08	Text	TEXT LABEL DESCRIBING THE STRATUM08.
	OPER	Text	OPERator of the specified pre block
Qry_list	internal_id	Long	Internal ID
	initial_order	Text	ORDER TO EXECUTE INITIALIZATION ACTIONS
	compile order	Text	ORDER TO INITIALIZE COMPILATION ACTIONS
	clean_order	Text	ORDER TO EXECUTE CLEAN UP ACTIONS
	sort_order	Long	ORDER TO EXECUTE QRY_LIST
	query_name	Text	NAME OF QUERY
	query_description	Text	DESCRIPTION OF WHAT QUERY DOES
OSTORY_MOD1_att	PID	Long	AVI Polygon Identifier (unique within each ats township)
	MER	Long	Meridian 5-6
	TWP	Long	Township
	RGE	Long	Range
	MODIFIER	Text	Primary Stand Condition Modifier
	EXTENT	Long	Extent Of Mod1
	YEAR	Long	Year of Mod1
OSTORY_MOD2_att	PID	Long	AVI Polygon Identifier (unique within each ats township)

Table Name	Field Name	Data Type	Field Description
	MER	Long	Meridian 5-6
	TWP	Long	Township
	RGE	Long	Range
	MODIFIER	Text	Primary Stand Condition Modifier
	EXTENT	Long	Extent Of Mod2
	YEAR	Long	Year of Mod2
temp COMPOSITE FOREST	PID	Decimal	Polygon identifier: unique to an interpreted polygon within a township, from 1 to 9999.
	MER	Decimal	Meridian: 5-6
	TWP	Decimal	Township: 82-103
	RGE	Decimal	Range: 1-26
	POLYID	Double	Unique standpoly id (smallest avi entity) in the ORACLE master database storing the AVI
	STANDID	Long	Unique STANDID (larger avi entity) in the ORACLE master database storing the AVI
	TEARDROP	Double	Lubicon traditional area flag as follows: 0 - not within teardrop, 1 - within teardrop
	IRTAG	Text	Native Reserves within the Appendix A deletions as follows:LUB - Lubicon, LCASET - Settlement areas adjacent to reserves, WC - Woodland Cree IR, LRC - Loon River Cree
	Id	Double	Internal ID – no longer used
	HYDROBUF	Text	Type of area buffered around each hydrographic type

Table Name	Field Name	Data Type	Field Description
	FIREYEAR	Double	The 4-digit year during which the fire occurred.
	FIRENUMBER	Text	Firenumber from input feature class fires
	LUCLASS	Text	land use class value
	RESERVATION	Text	Area with timber harvesting restriction: PNT, Recreation, Research, Sample plots
	FMA	Double	FMA flag: 0 - not within the FMA, 1 - within the FMA
	PARK_KEY	Long	Unique identifier of record from Parks input feature class
	BREAK	Double	Area of topographic concern: 1 - Area within incised valley, 2 - Area of rugged terrain, 3 - Area too steep to operate
	GRAZING	Long	Grazing range flag as follows: 0 - not within Grazing area, 1 - within Grazing area
	GRAZING_KEY	Long	Unique identifier of record from Grazing input feature class
	HARV_YEAR	Double	HARVEST YEAR: Timber Year in which skid cleared
	BLK_CLASS	Text	BLOCK CLASS from BLOCKS feature class: CUT - harvested portion of block; RET- Retention; REM- Removals(only GPSd polys)
	BLK_TYPE	Text	BLOCK TYPE: from BLOCKS feature class: Type of block component: US-Understory protection; I-Internal ; X-proximal; UN- Unmerch; FA- Flood; GR-Grass; SH-Shrubs; TP-Topography; LU-LandUse feature; TS- Tree size; DE-Density; HT- height
	BLK_TYPE_S	Text	BLOCK TYPE STATUS from BLOCK feature class:Source of

Table Name	Field Name	Data Type	Field Description
			retention/removal data: P-Planned; U-Unplanned
	BLK_SOURCE	Text	BLOCK SOURCE from BLOCKS feature class : Where did the spatial data come from? AVI_v1 = AVI 1989; GPS = layout; Plan = AOP planning; Update = photo update
	BLK_DET_ID	Double	BLOCK DETAILS IDENTIFIER: foreign key. Each record represents one opening record from ARIS in the Blk_details table
	DISPBLK	Text	Disposition Block:Concatenation of disposition and block number
	BLOCKS_KEY	Long	Unique identifier of record from blocks input feature class
	VI1_POLYID	Double	Unique polygon ID - Link into old Vegetation Inventory (AVI1) attributes (only within cutblocks)
	CARIBOU	Long	Caribou range flag as follows: 0 - not within caribou range, 1 - within caribou range
	OP_AREA	Text	Operating Areas
	MOOSE	Long	Moose range flag as follows:0 - not within moose zone, 1 - within River Valley moose zone, 2 - within Upland moose zone
	CMPKEY	Double	Unique key assigned to each composite forest polygon
	NATURAL	Text	Natural sub-regions: CMW - Central Mixed Wood, DMW - Dry Mixed wood, LBH - Lower Boreal Highlands, UBH - Upper Boreal Highlands
	CATCHKEY	Long	Unique identifier assigned to each polygon in the gauging-station

Table Name	Field Name	Data Type	Field Description
			catchment coverage.
	CRN	Long	Continuous reserve network value
	TRAPNO	Text	Trapeline number (provincial unique identifier)
	FMU	Text	Forest Management Unit - f1,p1N, P1S,p2,p3,p4,p5,p10, P11,s15
	TREEDAREAHA	Double	Area in Hectares of each composite forest polygon minus any overlapping seismic disturbance (seismic line buffered by 5m)
	SHAPE_Le_1	Double	Shapefile autogenerated polygon perimeter in metres
	SHAPE_AREA	Long	Shapefile autogenerated polygon area in metres squared
	AREAHA	Double	Area in Hectares of each composite forest polygon
	LU FLAG	Long	Binary flag indicating other disturbances, mainly due to oil-and-gas activity
	COMPARTMENT	Text	DMI Compartment name/number
	ZONENUM	Long	Number assigned to each cost zone. Only unique within one of three groups of FMUs
	ZONENAME	Text	Name assigned to each cost zone. If no name assigned, the name corresponds to the zone number.
	FMADEL	Double	Appendix “A” deletions as follows: 0 - not an Appendix “A” deletion, 1 - Appendix “A” deletion
	FIRENUM	Text	Unique name assigned to each fire

Table Name	Field Name	Data Type	Field Description
	WAM	Long	Wet Area Mapping based on the depth of the water table: 1 - 0.00 to 0.10m, 2 - 0.10 to 0.25m, 3 - 0.25 to 0.50m, 4 - 0.50 to 1.00m
	MPB_SR	Text	Mountain Pine Bettle Susceptibility Rating
	BLK_STATUS	Text	Block Status:CUT- block cut and photo confirmed, PLANNED - block laid out with GPS, FUTURE - future block, RET_INT - retention internal to block, RET_EXT - retention external to block
temp FLATTABLE	See Section 8.6, FLATFILE Data Dictionary		
temp MODEL_FOREST	CMPKEY	Double	COMPOSITE FOREST KEY
	POLYID	Long	POLYGON ID : UNIQUE IDENTIFIER OF AVI SMALLEST ENTITY RECORD
	BLOCKS_UK	Double	unique key from 'IN cutover summary' ' (Master update table that pulls all sources of past and future cuts together) Actual cuts up to 2008 season
	CONTRIBUTE	Long	CONTRIBUTES TO THE NET LANDBASE (0, 1)
	strBCGRP_C	Text	Character Code for Composite Broad Cover Group
	RIS LBASE	Text	LBASE as calculated by RIS - Composite weighting scheme used
	STRATIFICATION TYPE	Text	Type of stratification method used to update cutblocks or fires.
	Assigned Pathway	Long	Yield Curve Stratum

Table Name	Field Name	Data Type	Field Description
	age at inventory	Long	age at ref year
	AGE (YEARS)	Long	AGE IN YEARS at time zero (May 1, 2009)
	AGE(5)	Long	AGE IN NUMBER OF 5 YEAR PERIODS on May1, 2009
	AGE(10)	Long	AGE IN NUMBER OF 10 YEAR PERIODS on May1, 2009
	CUT PERIOD	Long	5 year CUT PERIOD FOR MODEL PRESCHEDULE
	ACTION	Long	MODELED ACTION BEING PRESCHEDULED
	PREBLOCK	Text	PREBLOCK FLAG (Y or Null)
	THEME1	Text	Theme1 in Woodstock model - Reserved keyword
	THEME2	Text	Theme2 in Woodstock model - Reserved keyword
	THEME3	Text	Theme3 in Woodstock model - Reserved keyword
	THEME4	Text	Theme4 in Woodstock model - Reserved keyword
	THEME5	Text	Theme5 in Woodstock model - Reserved keyword
	THEME6	Text	Theme6 in Woodstock MOdel - Reserved Keyword
	SD FLAG	Long	SUBJECTIVE DELETION FLAG (0, 1)
	MODEL LANDBASE	Text	Landbase used in model LD,LC, LE, VA, VN, NN, NA (Calculated Landbase from Composite Broad Cover Group)
	GRAZING FLAG	Long	Grazing range flag as follows:0 - not within Grazing range1 - within Grazing range

Table Name	Field Name	Data Type	Field Description
	BREAKS FLAG	Long	SUBJECTIVE DELETION FOR LAND BELOW BREAKS AND STEEP SLOPES (0,1)
	FMA FLAG	Long	Inside FMA = 1; Deleted or Outside FMA = 0
	LAND USE DEL FLAG	Long	SEISMIC, PIPELINES,ETC (0,1)
	WATER_BUFFER FLAG	Long	WATER COURSE BUFFERS AS PER GROUND RULES (0,1)
	deletion	Text	Priority Deletion Type
	nonfor	Text	non forest
	RESERV_DEL FLAG	Long	Area with timber harvesting restriction (0,1)
	CALC LBASE	Text	Calculated Landbase from Composite Broad Cover Group
	FMU	Text	Forest Management Unit - f1,p1N, P1S,p2,p3,p4,p5,p10, P11,s15
	AREAHA	Double	AREA IN HECTARES
	TREEDAREAHA	Double	TREED AREA IN HECTARES
	CATCHKEY	Text	CATCHMENT KEY: IDENTIFIER OF WATERSHED
	PATHWAY	Long	PATHWAY ASSIGNED IN 2011 YIELD CURVE METHODOLOGY : 0 TO 13
	PATHLABEL	Text	TEXT LABEL DESCRIBING THE PATHWAY ASSIGNED IN 2011 YIELD CURVE METHODOLOGY
	STRATUM08	Text	HEIGHT DEPENDANT STAND/STOCK TABLE STRATUM FROM 2008 YIELD CURVE METHODOLOGY
	STRATUMLABEL08	Text	TEXT LABEL DESCRIBING THE STRATUM08.

Table Name	Field Name	Data Type	Field Description
	OPER	Text	OPERator of the specified pre block
utilPATHWAY LABELS	PATHWAY	Long	Yield Curve Pathway from 2011 version
	PATHLABEL	Text	Text label for pathway 2011
utilSORT ORDER BUFFERS	buffer type	Text	Buffer Type
	sort order	Double	sort order
	description	Text	Buffer type & Landbase abbreviation
	Landbase	Text	Landbase abbreviation
	description level2	Text	Buffer type & Landbase description
utilSORT ORDER DELETIONS	deletion	Text	Deletion type
	SORT	Long	sort order
	label	Text	deletion label
utilSORT ORDER LAND USE	Model landbase	Text	Modelled landbase
	Level1 Stratum	Long	AVI Level 1 Strata
	sort order	Long	Order to sort linear disturbances in linear disturbance summary table
utilSORT ORDER LANDBASE	theme2	Text	Woodstock landbase call
	broad grouping	Text	Conifer, Deciduous or EMEND
	sort order	Long	Sort Order

Table Name	Field Name	Data Type	Field Description
utilSORT ORDER NONFOR	nonfor	Text	Non forested land type
	SORT	Long	Sort order
	label	Text	Description of land type
	grouping	Text	Non forested group type
	group2	Text	Abbreviation of non forested group type

12 CALCULATION OF FINAL RESULTS

The final product of the 44 queries is the “model forest” table. This table is used to update the fmu shapefiles with theme, ages and preschedules.

Thirteen additional queries are run to produce output tables that are exported to the Excel spreadsheet “west net landbase aug2011.xls”.

12.1.1 SUM1 GROSS AREA

This query calculates the gross area of the total landbase.

12.1.2 SUM2 DELETIONS

This query calculates the total area of each deletion type.

12.1.3 SUM2A REMOVALS NON-MERCH

This query calculates the total area of non-merchantable removed from blocks.

12.1.4 SUM3 NET LANDBASE

This query calculates the area of empirical and successional pathways within the conifer and deciduous net landbase.

12.1.5 SUM4 NONFOREST DETAILS

This query calculates the area of nonforest types.

12.1.6 SUM4 PREQUERY

Prequery for calculation of area of nonforest types.

12.1.7 SUM5 BUFFER DETAILS

This query calculates the area of different types of water buffers.

12.1.8 SUM6 STEEP DETAILS

This query calculates the area of different stratum beyond the breaks of incised valleys by landbase.

12.1.9 SUM7 SD DETAILS

This query calculates the area of different subjective deletions.

12.1.10 SUM7 PREQUERY

Prequery to calculate the area of different subjective deletions.

12.1.11 SUM8 LAND USE DETAILS

This query calculates the area of land use deletions by stratum and landbase.

12.1.12 SUM9 SB

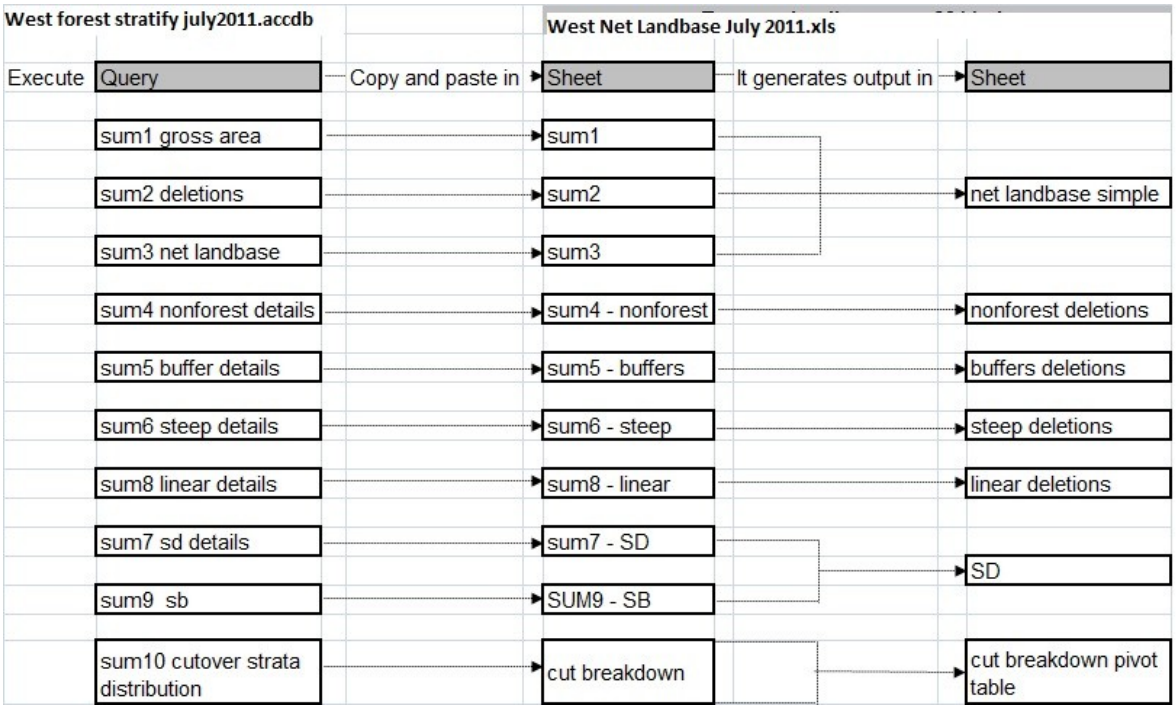
This query calculates the area of black spruce stands that are to be subjectively deleted

12.1.13 SUM10 CUTOVER STRATA DISTRIBUTION

This query calculates the area of cutovers broken down by landbase and stratification type.

12.2 PROCEDURE TO CALCULATE THE NET LANDBASE

After executing the series of queries in Access file “west forest stratify aug2011.accdb” as described above, the procedure to replicate the net landbase summary tables is presented in the flowchart below. Eleven other queries are executed in “west forest stratify aug2011.mdb” and their results copied and pasted in specified sheets in the Excel spreadsheet “west net landbase aug2011.xls”. The landbase summary tables are automatically generated in specified sheets in the same workbook.



13 NET LAND BASE RESULTS

The following tables show the results of the net landbase calculation for FMA West.

13.1 NET LANDBASE

FMA WEST Net Landbase

	Treedarea(ha)	Polygon Count	Running Tally Treedarea(ha)	Running Tally Polygon Count
Gross Dataset	**959,552**	**366,272**	959,552	366,272
DELETIONS				
Indian Reserves / Settlements	0	0	959,552	366,272
Non-FMA	12,879	5,260	946,673	361,012
Swan Nesting Lake Buffer	5,784	2,444	940,889	358,568
Lake Buffer	4,859	3,708	936,030	354,860
Large Permanent Stream Buffer	2,061	1,296	933,970	353,564
Small Permanent Stream Buffer	10,198	13,572	923,772	339,992
Land Use Disturbance	9,238	54,183	914,534	285,809
Non Forest	61,905	27,756	852,629	258,053
Steep / Below Breaks of Incised Valleys	17,408	7,338	835,221	250,715
Black Spruce Non Productive	196,959	26,029	638,262	224,686
Subjective Deletions	33,514	9,761	604,748	214,925
Grazing Area	0	0	604,748	214,925
PNT and Research Area	629	859	604,119	214,066
Recent Burn	345	495	603,774	213,571
No Stratification	1,129	3,504	602,645	210,067
Private land	124	279	602,521	209,788
Removals: Non-merch	37	164	602,484	209,624
Total	**357,067**	**156,648**		
Net Landbase				
Conifer (LCIN) - Empirical Pathways	227,330	37,733	375,154	171,891
Conifer Sensitive Site (LCSEN) - Empirical Pathways	4,986	993	370,169	170,898
Conifer Empirical Total	232,316	38,726		
Conifer (LCIN) - Successional Pathways	111,544	68,650	258,624	102,248
Conifer Sensitive Site (LCSEN) - Successional Pathways	2,502	1,063	256,122	101,185
Conifer Successional Total	114,046	69,713		
Conifer - Net Landbase	**346,362**	**108,439**		
Deciduous (LDIN) - Empirical Pathways	5,048	1,502	251,074	99,683
Deciduous Sensitive Site (LDSEN) - Empirical Pathways	45	2	251,029	99,681
Deciduous Empirical Total	5,093	1,504		
Deciduous (LDIN) - Successional Pathways	234,871	93,506	16,158	6,175
Deciduous Sensitive Site (LDSEN) - Successional Pathways	11,601	2,636	4,557	3,539
Deciduous Successional Total	246,472	96,142		
Deciduous - Net Landbase	**251,565**	**97,646**		
EMEND	**4,557**	**3,539**	0	0
Total Net Landbase	**597,927**	**206,085**		

Net Landbase FMA WEST Formulation August 2011
Stratification version <FMA WEST> August 15, 2011

13.2 BUFFERS

FMA WEST Buffers Details

Landbase	Swan nesting lake		Lake		Large permanent streams		Small permanent streams		Total Buffer	
	Treedarea(ha)	Polygon Count	Treedarea(ha)	Polygon Count	Treedarea(ha)	Polygon Count	Treedarea(ha)	Polygon Count	Treedarea(ha)	Polygon Count
Conifer	2,711	1,172	2,992	2,145	773	428	5,759	7,872	12,234	11,617
Deciduous	2,162	784	578	925	1,211	714	1,380	3,615	5,331	6,038
EMEND	19	11	52	46	-	-	19	57	90	114
Productive Land Total	**4,892**	**1,967**	**3,622**	**3,116**	**1,984**	**1,142**	**7,158**	**11,544**	**17,656**	**17,769**
Natural Non Vegetated (NN)	236	126	34	38	18	26	137	109	425	299
Non Forest Vegetated Natural (VN)	641	278	1,188	476	56	91	2,876	1,579	4,761	2,424
Non Vegetated Anthropogenic (NA)	8	46	8	52	0	4	15	217	32	319
Non Forest Vegetated Anthropogenic (VA)	7	27	7	26	2	33	12	123	28	209
Non-Forest Total	892	477	1,237	592	77	154	3,040	2,028	5,245	3,251
Total	**5,784**	**2,444**	**4,859**	**3,708**	**2,061**	**1,296**	**10,198**	**13,572**	**22,901**	**21,020**

Net Landbase FMA WEST Formulation August 2011
Stratification version <FMA WEST> August 15, 2011

13.3 LAND USE

FMA WEST Land Use Deletions Details

MODEL LANDBASE	Stratum #	Stratum Label	Treedarea(ha)	Polygon Count
Conifer Landbase	0	NFC	3	39
	1	Aspen>>Shrub	15	81
	2	Aspen>>WhiteSpruce	63	405
	3	Aspen>>LateMixed>>WhiteSpruce	93	724
	4	Aspen>>EarlyMixed>>WhiteSpruce	193	1,866
	5	AspenMixed>>WhiteSpruce	173	1,344
	6	WhiteSpruce>>WhiteSpruce	409	4,863
	7	Pine	414	2,783
	8	Pine-BlackSpruce-Deciduous	182	1,105
	9	Deciduous-Pine-BlackSpruce	92	572
	10	Pine-WhiteSpruce	132	1,099
	12	BlackSpruce-Pine/WhiteSpruce	488	3,196
		Conifer Landbase Total	**2,257**	**18,077**

MODEL LANDBASE	Stratum #	Stratum Label	Treedarea(ha)	Polygon Count
Deciduous Landbase	13	BlackSpruce	941	6,367
	0	NFC	0	3
	1	Aspen>>Shrub	1,178	10,003
	2	Aspen>>WhiteSpruce	407	2,809
	3	Aspen>>LateMixed>>WhiteSpruce	204	1,402
	4	Aspen>>EarlyMixed>>WhiteSpruce	120	885
	5	AspenMixed>>WhiteSpruce	71	843
	6	WhiteSpruce>>WhiteSpruce	41	327
	7	Pine	1	13
	8	Pine-BlackSpruce-Deciduous	6	51
	9	Deciduous-Pine-BlackSpruce	17	142
	10	Pine-WhiteSpruce	4	27
	11	BalsamPoplar>>Shrub	124	949
		Deciduous Landbase Total	**3,115**	**23,821**

MODEL LANDBASE	Stratum #	Stratum Label	Treedarea(ha)	Polygon Count
EMEND	12	BlackSpruce-Pine/WhiteSpruce	1	6
	13	BlackSpruce	0	4
	0	NFC	3	110
	1	Aspen>>Shrub	10	147
	2	Aspen>>WhiteSpruce	7	49
	3	Aspen>>LateMixed>>WhiteSpruce	4	27
	4	Aspen>>EarlyMixed>>WhiteSpruce	3	25
	5	AspenMixed>>WhiteSpruce	3	29
	6	WhiteSpruce>>WhiteSpruce	6	111
	7	Pine	0	5
	9	Deciduous-Pine-BlackSpruce	0	8
	10	Pine-WhiteSpruce	1	12
		EMEND Landbase Total	**37**	**533**

Anthropogenic Non-Vegetated	11	BalsamPoplar>>Shrub	1	8
	12	BlackSpruce-Pine/WhiteSpruce	1	17
	13	BlackSpruce	3	31
	0	NFC	1,913	4,777
	0	NFC	12	153
		NA Total	**1,931**	**4,986**
Naturally Non-Vegetated	0	NFC	1,598	4,214
	0	NFC	300	2,551
		NN Total	**1,898**	**6,765**
Anthropogenic Vegetated	6	WhiteSpruce>>WhiteSpruce	0	1
	0	0	0	0
	0	0	0	0
	0	0	0	0
	0	0	0	0
		VA Total	**0**	**1**
Naturally Vegetated	0	0	0	0
	0	0	0	0
	0	0	0	0
	0	0	0	0
	0	0	0	0
		VN Total	-	-
Deletions Landbase Total			**3,829**	**11,752**
		Total Land Use Deletions	**9,238**	**54,183**

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13.4 NON FOREST

FMA WEST Non Forest Deletions Details

Non Forest Category				
Non-Forest Landbase Code	**AVI Code**	**Description**	**Treedarea (ha)**	**Polygon Count**
Water	WL	Natural Non-Vegetated Water Lake	3,305	505
Water	WR	Natural Non-Vegetated Water River	694	77
Water	WF	Natural Non-Vegetated Water Flooded	4,026	1,368
		Water Total	**8,025**	**1,950**
Natural Non Vegetated	MC	Natural Non-Vegetated Mineral Cutbank	3	3
Natural Non Vegetated	MS	Natural Non-Vegetated Mineral Sand	2	2
Natural Non-Vegetated	MB	Natural Non-Vegetated Mineral Burn	222	14
Natural Non-Vegetated	MR	Natural Non-Vegetated Mineral Rock	-	-
		Natural Non-Vegetated Total	**227**	**19**
Natural Non-Forest	HF	Natural Vegetated Forbs	29	6
Natural Non-Forest	HG	Natural Vegetated Grass	7,806	5,873
Natural Non-Forest	BR	Natural Vegetated Moss	-	-
Natural Non-Forest	SC	Natural Vegetated Closed Shrub	39,439	11,784
Natural Non-Forest	SO	Natural Vegetated Open Shrub	4,500	1,509
		Natural Vegetated Total	**51,774**	**19,172**
Industrial Non-Vegetated	IH	Anthropogenic Non-Vegetated Industrial Right of Way	791	3,041
Industrial Non-Vegetated	IG	Anthropogenic Non-Vegetated Industrial Gravel	55	81
Industrial Non-Vegetated	II	Anthropogenic Non-Vegetated Industrial Millsite	12	55
Industrial Non-Vegetated	IC	Anthropogenic Non-Vegetated Industrial Clearing	-	-
Industrial Non-Forest	IW	Anthropogenic Vegetated Wellsite	436	2,003
Industrial Non-Vegetated	SR	Anthropogenic Non-Vegetated Ribbon Development	-	-
		Anthropogenic Non-Vegetated Total	**1,295**	**5,180**
Industrial Non-Vegetated	GR	Anthropogenic Non-Vegetated Grazing	-	-
Industrial Non-Vegetated	IF	Anthropogenic Non-Vegetated Farmstead	5	1
Industrial Non-Forest	P	Anthropogenic Vegetated Perennial Crops	-	-
Industrial Non-Forest	IP	Anthropogenic Vegetated Right of Way	576	1,429
Industrial Non-Forest	A	Anthropogenic Vegetated Annual Crops	3	5
		Anthropogenic Vegetated Total	**584**	**1,435**
Total Non Forest Deletion			**61,905**	**27,756**

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13.5 STEEP SLOPES & BREAKS

FMA WEST Productive Land Below Breaks of Incised Valleys

Landbase	Level1 Stratum	Treedarea(ha)	Polygon Count
Conifer Landbase	1	0	1
	2	88	44
	3	147	131
	4	435	169
	5	1,010	361
	6	2,431	1,431
	7	543	254
	8	255	252
	9	58	76
	10	48	70
	12	115	142
	13	499	625
	TOTAL	**5,631**	**3,556**
Deciduous Landbase	1	8,250	2,375
	2	1,557	488
	3	703	287
	4	324	154
	5	44	28
	6	346	108
	8	2	3
	9	81	52
	10	4	1
	11	466	286
	TOTAL	**11,777**	**3,782**
	Total Productive Land	**17,408**	**7,338**
	NA	-	-
	NN	-	-
	VA	-	-
	VN	-	-
	Total Non-Productive Land	**-**	**-**
	Total Land	**17,408**	**7,338**

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13.6 SUBJECTIVE DELETIONS

FMA WEST Subjective Deletions

Subjective Deletions	Treedarea (ha)	Polygon Count
Conifer Landbase, 'A' Density with no understory	12,906	4,208
Conifer landbase, Larch leading	45	9
Conifer Landbase, TPR = 'U'	1,222	237
Conifer Total	**14,173**	**4,454**
Deciduous Landbase, 'A' Density with no understory	18,493	4,350
DeciduousLandbase, TPR = 'U'	575	400
Deciduous Total	**19,069**	**4,750**
EMEND Landbase, 'A' Density with no understory	138	190
EMEND landbase, Larch leading		
EMEND Landbase, TPR = 'U'	31	28
EMEND Total	**169**	**218**
Vegetated Naturally (VN) with TPR 'U'	104	339
VN Total	**104**	**339**
Total Subjective Deletions	**33,514**	**9,761**

Black Spruce Deletions

Level1 Stratum	Treedarea (ha)	Polygon Count
13 - Black Spruce	196,959	26,029
Total Black Spruce Deletions	**196,959**	**26,029**

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13.7 SEISMIC REMOVED

Area of Seismic Lines Removed from Net Landbase

LANDBASE	TOTAL STAND AREA (AREAHA)	NET STAND AREA (TREEDAREAHA)	Seismic Removed (AREAHA - TREEDAREAHA)
LC	349,632	346,362	3,270
LD	254,261	251,565	2,695
Total Net Landbase Affected	**603,893**	**597,927**	**5,965**

14 "FLATFILE" DATA DICTIONARY

As per ASRD request, a flat table was built of all applicable items used in the processing steps. The actual work is completed with a relational database. The final answers and the calculated fields along the path are presented in Temp Flat Table. Because of size restrictions, only items that actually are used are put in the table. There are many instances of the same item used in multiple tables. Most of these double versions have been left out of the flat table. The original source table is used to populate a given item if possible.

As an addendum, a second copy of the flat table is provided in the MS-Access file flat_west.accdb. Inside is a table called flat_table_west. This is a copy of the Temp Flat Table that has had the Origin Update fields manually added. **It is likely best that the reviewers should use this flat table as the test data during review.**

If there are any discrepancies between text descriptions in the flat table description and the individual table description, the flat table description prevails as the most up-to-date text description.

14.1 FLAT TABLE DESCRIPTION

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
temp FLATTABLE; Flat_Table_east; Flat_Table_West	CMPKEY	Temp MODEL_FOREST – Originates from composite forest creation process	Double	COMPOSITE FOREST KEY : unique identifier of smallest entity in the final composite forest spatial product.	Integer values: P10 (also known as P19 North and VSA1) between 1000001 and 1078655. P19south (also known as VSA2 or P2/P1n/P11/P1) between 3000001 and 3287617 East FMA between 4000001 and 4499352
temp FLATTABLE; Flat_Table_east; Flat_Table_West	POLYID	Temp MODEL_FOREST – Originates from AVI VI Oracle process. Definitive source is Stand Poly table	Long	POLYGON ID : UNIQUE IDENTIFIER OF AVI SMALLEST ENTITY RECORD Each TWP-RGE-MER-PID unique combo (formerly called 'forestkey') has a unique polyid	Integer values auto generated by Oracle within VI program.
temp FLATTABLE; Flat_Table_east;	BLOCKS_UK	Blocks feature class in the input geodatabase	Double	unique key from 'IN cutover summary' ' (Master update table	Integer values. Unique values represent a block

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
Flat_Table_West		Originating item is called "blocks_key".		that pulls all sources of past and future cuts together) Actual cuts up to 2010 season	fragment. One cutover may contain many fragments.
temp FLATTABLE; Flat_Table_east; Flat_Table_West	CONTRIBUTE	Temp MODEL_FOREST Calculated during the net landbase forest stratification.	Long	Calculated field from forest stratification process. Flags polygons as belonging to net landbase or not.	1= in the net landbase 0 = not in the net landbase
temp FLATTABLE; Flat_Table_east; Flat_Table_West	TREEDAREAHA	In Composite Forest West or in composite forest east. Definitive source is the composite forest attribute table from the input geodatabase.	Double	Area in Hectares of each composite forest polygon minus any overlapping seismic disturbance (seismic line buffered by 5m). Calculated in the net land base spatial processing steps.	Decimal numbers.
temp FLATTABLE; Flat_Table_east; Flat_Table_West	AREAHA	In Composite Forest West or in composite forest east.. Definitive source is the composite forest attribute table from the input geodatabase	Double	Total composite forest polygon AREA IN HECTARES. Shape_Area/10000 from the geodatabase final composite spatial product.	Decimal Numbers
temp FLATTABLE; Flat_Table_east; Flat_Table_West	TWP	In OSCOVER	Long	Township from AVI.	Integer values from 80 to 103
temp FLATTABLE; Flat_Table_east; Flat_Table_West	RGE	In OSCOVER	Long	Range from AVI	Integer values from 1 to 26
temp FLATTABLE; Flat_Table_east; Flat_Table_West	MER	In OSCOVER	Long	Meridian from AVI	Integer value 5 or 6
temp FLATTABLE; Flat_Table_east; Flat_Table_West	PID	In OSCOVER	Long	Polygon Identifier: unique to an interpreted polygon within a township,	Integer value between 1 and 9999
temp FLATTABLE; Flat_Table_east; Flat_Table_West	strBCGRP_C	In STAND DATA	Text	Character Code for Composite Broad Cover Group. Calculated during AVI processing	NULL – non forested C - Conifer CD – Conifer leading mixedwood DC – Deciduous leading mixedwood D - Deciduous
temp FLATTABLE; Flat_Table_east; Flat_Table_West	RIS LBASE	In STAND DATA	Text	LBASE as calculated by RIS - Composite weighting scheme used Present for future DMI internal use – not used for decisions in this submission	NULL – non forested C - Conifer CD – Conifer leading mixedwood DC – Deciduous leading mixedwood D - Deciduous

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
temp FLATTABLE; Flat_Table_east; Flat_Table_West	STRATIFICATION TYPE	Temp MODEL_FOREST	Text	Type of stratification method used to update cutblocks or fires. Calculated by the forest stratification process. Maintained as an aid in debugging anomalies.	AVI NON-TREED CUT ASSIGNED YC ASSIGNED AGE CUT ASSIGNED YC ASSIGNED AGE - BURN MOD CUT AVI YC ASSIGNED AGE CUT AVI YC AVI AGE DEFAULT AVI POST AVI BURN ref-cc-burn REMOVALS NON MERCH RETENTION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	Assigned Pathway	Temp MODEL_FOREST	Long	Yield Curve Stratum assigned by the cutover stratification and/or forest stratification processes. This is the final overwrite going into the TSA model.	Integer value from 0 to 13
temp FLATTABLE; Flat_Table_east; Flat_Table_West	age at inventory	Temp MODEL_FOREST	Long	Age of the AVI forest polygon on day photo was flown. Calculated from ORIGIN and REFYEAR during forest stratification.	NULL = no origin ie non forested Integer value between 0 and 243.
temp FLATTABLE; Flat_Table_east; Flat_Table_West	AGE(YEARS)	Temp MODEL_FOREST	Long	AGE IN YEARS at time zero (May 1, 2009)	NULL = no origin ie non forested Integer value between 0 and 249
temp FLATTABLE; Flat_Table_east; Flat_Table_West	AGE(5)	Temp MODEL_FOREST	Long	AGE IN NUMBER OF 5 YEAR PERIODS on May1, 2009	NULL or 0 = no origin ie non forested Integer value between 1 and 50
temp FLATTABLE; Flat_Table_east; Flat_Table_West	AGE(10)	Temp MODEL_FOREST	Long	AGE IN NUMBER OF 10 YEAR PERIODS on May1, 2009	NULL = no origin ie non forested Integer value between 1 and 25
temp FLATTABLE; Flat_Table_east; Flat_Table_West	CUT PERIOD	In WEST PREBLOCK ; in EAST PREBLOCK	Long	10 year CUT PERIOD FOR MODEL PRESCHEDULE. Not populated for all pre blocks	NULL – not predetermined by operator Integer value between 1 and 4
temp FLATTABLE; Flat_Table_east; Flat_Table_West	ACTION	In WEST PREBLOCK; in EAST PREBLOCK	Long	MODELED ACTION BEING PRESCHEDULED. Just a placeholder until forecasting work determines actual Woodstock formulation	0 = not populated 1 = generic harvest flag
temp FLATTABLE; Flat_Table_east; Flat_Table_West	PREBLOCK	In WEST PREBLOCK; in EAST PREBLOCK	Text	PREBLOCK FLAG (Y or Null)	Null = do not tell Woodstock to cut this Y = Tell Woodstock to cut this
temp FLATTABLE;	OPER	In WEST PREBLOCK; in EAST	Text	OPERator of the specified	NULL = no operator

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
Flat_Table_east; Flat_Table_West		PREBLOCK		pre block	assigned CFP = CanFor DMI = DMI ZAV = Zavisha Sawmills Tolko = Tolko Zav=Zavisha BUCH= Buchannan BOUCH = Boucher MTU= Alberta Seehta
temp FLATTABLE; Flat_Table_east; Flat_Table_West	THEME1	Temp MODEL_FOREST	Text	Theme1 in Woodstock : Yield Curve assigned	0 to 13
temp FLATTABLE; Flat_Table_east; Flat_Table_West	THEME2	Temp MODEL_FOREST	Text	Theme2 in Woodstock model: LandBase	LCIN – Contributing Conifer Landbase LCSEN – Contributing conifer landbase on rugged terrain LDIN – Deciduous contributing landbase LDSEN – Contributing Deciduous landbase on rugged terrain LE – EMEND landbase noncontributing landbase OTHER – Noncontributing landbase
temp FLATTABLE; Flat_Table_east; Flat_Table_West	THEME3	Temp MODEL_FOREST	Text	Theme3 in Woodstock model : Status	BURN – Recent burn LINEAR – LandUse deletion MAN – Managed (known cutover) NAT – Natural stand OTHER- non-forest RET – Retention patch
temp FLATTABLE; Flat_Table_east; Flat_Table_West	THEME4	Temp MODEL_FOREST	Text	Theme4 in Woodstock model : Forest Management Unit by which decisions are to be made in the DFMP	P10 P11 P1N P1S P2 P3 P4 P5 F1 S15
temp FLATTABLE; Flat_Table_east; Flat_Table_West	THEME5	Temp MODEL_FOREST	Text	Theme5 in Woodstock model :Mountain Pine Beetle Susceptibility. Placeholder at this time not used.	Zz – placeholder - Item not used
temp FLATTABLE; Flat_Table_east; Flat_Table_West	THEME6	Temp MODEL_FOREST	Text	Theme6 in Woodstock Model – Cost Zones	'D'& <integer value from 1 to 75> & 'C' & <integer value from 1 to 75>

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
temp FLATTABLE; Flat_Table_east; Flat_Table_West	SD FLAG	Temp MODEL_FOREST	Long	SUBJECTIVE DELETION FLAG marks whether the stratification process has deleted this poly for a known SD	0 = not a subjective deletion 1= is a subjective deletion
temp FLATTABLE; Flat_Table_east; Flat_Table_West	MODEL LANDBASE	Temp MODEL_FOREST Originates in STAND DATA	Text	Landbase category from DMI internal AVI calculations. Used for quick summaries – not used in this submission. (Calculated Landbase from Composite Broad Cover Group)	LC = Conifer Landbase LD= Deciduous Landbase LE=EMEND Landbase NA= NonForested Anthropogenic NN= Natural nonForest VA= Vegetated Anthropogenic VN= Vegetated Natural
temp FLATTABLE; Flat_Table_east; Flat_Table_West	GRAZING FLAG	Temp MODEL_FOREST	Long	Grazing range flag: Grazing dispositions that do not preclude harvest.	0 – not within Grazing range 1 – within Grazing range
temp FLATTABLE; Flat_Table_east; Flat_Table_West	BREAKS FLAG	Temp MODEL_FOREST	Long	SUBJECTIVE DELETION FOR LAND BELOW BREAKS AND STEEP SLOPES)	0= not below breaks 1=is below breaks (out of net landbase) 2=Rugged terrain (in net landbase) 3= Steep as identified by AVI (out of Net landbase)
temp FLATTABLE; Flat_Table_east; Flat_Table_West	FMA FLAG	Temp MODEL_FOREST	Long	Inside FMA Flag	0=Outside FMA 1= Inside FMA
temp FLATTABLE; Flat_Table_east; Flat_Table_West	LAND USE DEL FLAG	Temp MODEL_FOREST	Long	SEISMIC, PIPELINES,ETC	0 = not a landuse deletion 1= is a landuse deletion
temp FLATTABLE; Flat_Table_east; Flat_Table_West	WATER_BUFFER FLAG	Temp MODEL_FOREST	Long	WATER COURSE BUFFERS Flag:	0= not in a buffer 1 = in a buffer
temp FLATTABLE; Flat_Table_east; Flat_Table_West	deletion1	Temp MODEL_FOREST	Text	Priority Deletion Type: All deletions are flagged so that all combinations can be identified. This is the priority deletion that 'most' kicks it out of the net landbase. It is used for reporting purposes in the net landbase document. It is calculated in the forest stratification process	BURN LAKE LAND USE LRG_PERM NO HARVEST NO STRAT NONFMA NONFOREST PRIVATE Sb SD SM_PERM STEEP SWAN
temp FLATTABLE; Flat_Table_east;	nonfor	In STAND DATA	Text	Non Forest Calls: Multiple AVI Ostory fields	NULL = not a nonfor; must be forested

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
Flat_Table_West		Originates in multiple AVI ostory fields		contain non-forest categories. These are pulled together in one field for internal DMI queries to add efficiencies.	A HF HG IF IG IH II IP IW MB MC MS P SC SO SR WF WL WR
temp FLATTABLE; Flat_Table_east; Flat_Table_West	RESERV_DEL FLAG	Temp MODEL_FOREST	Long	Area with timber harvesting restriction	0 = no harvest restriction 1= has a harvest restriction (eg PSP plots, research plots, PNTs)
temp FLATTABLE; Flat_Table_east; Flat_Table_West	CALC LBASE	Temp MODEL_FOREST Originates in STAND DATA – DMI internal use	Text	Calculated Landbase from Composite Broad Cover Group: Applies recent historical landbase designation rules based on FMU and AVI BCGRP. Does not utilize cutover information.	LC = Conifer LD= Deciduous XX= Non Contributing
temp FLATTABLE; Flat_Table_east; Flat_Table_West	FMU	In OSCOVER	Text	Forest Management Unit from AVI – Old ones used because they still have political and business relevance – they are required for decision making in this DFMP	P10 P11 P1N P1S P2 P3, P4, P5, F1, S15
temp FLATTABLE; Flat_Table_east; Flat_Table_West	FMU2	In CUTOVER SUMMARY	Text	Forest Management Unit assigned to cutblocks- Workaround for slivers of blocks that stray over FMU lines and would otherwise cause false reporting.	P10 P11 P1N P1S P2 P3, P4, P5, F1, S15
temp FLATTABLE; Flat_Table_east; Flat_Table_West	New_FMU	In COMPOSITE FOREST WEST	Text	Current official Forest Management Unit	P19 FOR West P3, P4, P5, F1, S15 for East
temp FLATTABLE; Flat_Table_West	VSA	In COMPOSITE FOREST WEST	Text	Volume Supply Area label for west fma volume supply areas	VSA1 = P10 (or P19 North) VSA2 = P1&P2&P11 (or P19 south)
temp FLATTABLE; Flat_Table_east;	CATCHKEY	In COMPOSITE FOREST WEST	Text	CATCHMENT KEY: IDENTIFIER OF	105 116

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
Flat_Table_West				WATERSHED: Also the foreign key to link into the input geodatabase. These are the PFRA gauged watersheds aligned with the HYDAT data.	137 140 141 145 149 154 172 194 202 209 210 217 219 227 231
temp FLATTABLE; Flat_Table_east; Flat_Table_West	PATHWAY1	Temp MODEL_FOREST Originates in VI_STRATA	Long	PATHWAY ASSIGNED IN 2011 YIELD CURVE METHODOLOGY : Default yield curve stratification based on AVI attributes before any overrides from newer update information. 'Yield Curve assigned on day of AVI photo using only AVI information'	Integer value from 0 to 13
temp FLATTABLE; Flat_Table_east; Flat_Table_West	PATHLABEL	Temp MODEL_FOREST Originates in VI_STRATA	Text	TEXT LABEL DESCRIBING THE PATHWAY ASSIGNED IN 2011 YIELD CURVE METHODOLOGY	PATHLABEL Aspen>>EarlyMixed>>WhiteSpruce Aspen>>LateMixed>>WhiteSpruce Aspen>>Shrub Aspen>>WhiteSpruce AspenMixed>>WhiteSpruce BalsamPoplar>>Shrub BlackSpruce BlackSpruce-Pine/Whitespruce Deciduous-Pine-BlackSpruce NFC Pine Pine-BlackSpruce-Deciduous Pine-WhiteSpruce Wspruce>>WhiteSpruce
temp FLATTABLE; Flat_Table_east; Flat_Table_West	compflag	In STAND DATA	Text	Flags the status of the composite BCGRP weighting scheme. Explains where the stand data record comes from.	C= Composite of overstory and understory calls using the weighting scheme O= Uses the overstory calls only to determine BCGRP U= uses the Understory only to determine the BCGRP

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
temp FLATTABLE; Flat_Table_east; Flat_Table_West	intBCGRP	In STAND DATA	Long	Integer Code for overstory Broad Cover Group	-1= non forested Integer values represent Deciduous Content 0= 0% 1=10% 2=20% 3=30% 4=40 5=50% 6=60% 7=70% 8=80% 9=90% 10=100%
temp FLATTABLE; Flat_Table_east; Flat_Table_West	strBCGRP	In STAND DATA	Text	Character Code for overstory Broad Cover Group	NULL – non forested C - Conifer CD – Conifer leading mixedwood DC – Deciduous leading mixedwood D - Deciduous
temp FLATTABLE; Flat_Table_east; Flat_Table_West	intBCGRP_C	In STAND DATA	Long	Integer Code for Composite Broad Cover Group	-1= non forested Integer values represent Deciduous Content 0= 0% 1=10% 2=20% 3=30% 4=40 5=50% 6=60% 7=70% 8=80% 9=90% 10=100%
temp FLATTABLE; Flat_Table_east; Flat_Table_West	LEADSP	In STAND DATA	Text	Leading species – single most prevalent species	NULL Aw Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	HEIGHT	In STAND DATA	Long	Height in 1 m classes	-1 = nonforest Integer Values from 0 to 34
temp FLATTABLE; Flat_Table_east; Flat_Table_West	HT6M	In STAND DATA	Integer	Height in 6 m classes – carry over from Phase3 methods.	-1=nonforest Integer values from 0 to 6
temp FLATTABLE; Flat_Table_east; Flat_Table_West	DENSITY	In STAND DATA	Text	AVI Density Class A,B,C,D	NULL = nonforest A B C D

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
temp FLATTABLE;	in STAND DATA_ORIGIN	In STAND DATA	Long	10 year origin class from the adjusted or 2010 calculation	Integer decade classes: 0 1770 to 2000
temp FLATTABLE; Flat_Table_east; Flat_Table_West	TPR	In STAND DATA	Text	Overstory Timber Productivity Rating assigned by photo interpreter. – This is the one used in yields and net landbase.	Null= not a productive forest type U=unproductive forest F=fair M=medium G=good
temp FLATTABLE; Flat_Table_east; Flat_Table_West	OS_LBASE	In STAND DATA	Text	Overstory Landbase based on AVI ostory only	LC LD XX
temp FLATTABLE; Flat_Table_east; Flat_Table_West	US_LBASE	In STAND DATA	Text	Understory Landbase based on understory only	LC LD XX
temp FLATTABLE; Flat_Table_east; Flat_Table_West	CALC LBASE_O	In STAND DATA	Text	Calculated Landbase from overstory Broad Cover Group	LC LD XX
temp FLATTABLE; Flat_Table_east; Flat_Table_West	CALC LBASE2	In STAND DATA	Text	Calculated Landbase from Composite Broad Cover Group	LC LD XX
temp FLATTABLE; Flat_Table_east; Flat_Table_West	in STAND DATA_DELETION	In STAND DATA	Text	Deletion Type – Blank not used	Blank not used
temp FLATTABLE; Flat_Table_east; Flat_Table_West	NONFOREST	In STAND DATA	Text	Non Forest Calls: Multiple AVI Ostory fields contain non-forest categories. These are pulled together in one field for internal DMI queries to add efficiencies	NULL = not a nonfor; must be forested A HF HG IF IG IH II IP IW MB MC MS P SC SO SR WF WL WR
temp FLATTABLE; Flat_Table_east; Flat_Table_West	species group		Text	Species Group: major species categories used for exploratory work	species group AW AW-FB AW-LT AW-P AW-SB

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
					AW-SW BW BW-FB BW-LT BW-P BW-SB BW-SW FB FB-AW FB-BW FB-PB LT LT-AW LT-BW LT-PB non-treed P P-AW PB PB-FB PB-LT PB-P PB-SB PB-SW P-BW P-PB SB SB-AW SB-BW SB-PB SW SW-AW SW-BW SW-PB
temp FLATTABLE; Flat_Table_east; Flat_Table_West	PATHWAY	In VI STRATA	Double	PATHWAY ASSIGNED IN 2011 YIELD CURVE METHODOLOGY: Default yield curve stratification based on AVI attributes before any overrides from newer update information. 'Yield Curve assigned on day of AVI photo using only AVI information'	Integer value from 0 to 13
temp FLATTABLE; Flat_Table_east; Flat_Table_West	LABEL	In VI STRATA	Text	TEXT LABEL DESCRIBING THE PATHWAY ASSIGNED IN 2011 YIELD CURVE METHODOLOGY	PATHLABEL Aspen>>EarlyMixed>>WhiteSpruce Aspen>>LateMixed>>WhiteSpruce Aspen>>Shrub Aspen>>WhiteSpruce AspenMixed>>WhiteSpruce BalsamPoplar>>Shrub BlackSpruce BlackSpruce-Pine/Whitespruce Deciduous-Pine-

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
					BlackSpruce NFC Pine Pine-BlackSpruce-Deciduous Pine-WhiteSpruce Wspruce>>WhiteSpruce
temp FLATTABLE; Flat_Table_east; Flat_Table_West	REFAGE	In VI STRATA	Double	reference age (ie age on date photo was flown) used for regression in yc development	Integer values
temp FLATTABLE; Flat_Table_east; Flat_Table_West	PATHWAY_AGE	In VI STRATA	Integer	age used in regression - (last full 10 years period fully achieved) eg 47 years old = currently in period 5 = age 40	Integer values
temp FLATTABLE; Flat_Table_east; Flat_Table_West	MOISTURE_OSCOVER	In OSCOVER	Text	Moisture Regime 'd' , 'a', 'w', 'm' (from table: in OSCOVER)	d a w m
temp FLATTABLE; Flat_Table_east; Flat_Table_West	CC_OSCOVER	In OSCOVER	Text	Overstorey Crown Closure - 25% classes A, B, C, D	A B C D
temp FLATTABLE; Flat_Table_east; Flat_Table_West	HEIGHT_OSCOVER	In OSCOVER	Long	1metre height class	Integer values 0 to 34
temp FLATTABLE; Flat_Table_east; Flat_Table_West	S1	In OSCOVER	Text	Species 1(from table: in OSCOVER)	null Aw Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	P1	In OSCOVER	Long	Percentage Crown Closure of Species 1 - 10% classes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	S2	In OSCOVER	Text	Species 2	null Aw Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	P2	In OSCOVER	Long	Percentage Crown Closure of Species 2 - 10% classes	Integer values 0 to 10
temp FLATTABLE;	S3	In OSCOVER	Text	Species 3	null Aw

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
Flat_Table_east; Flat_Table_West					Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	P3	In OSCOVER	Long	Percentage Crown Closure of Species 3 - 10% classes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	S4	In OSCOVER	Text	Species 4	null Aw Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	P4	In OSCOVER	Long	Percentage Crown Closure of Species 4 - 10% classes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	S5	In OSCOVER	Text	Species 5	null Aw Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	P5	In OSCOVER	Long	Percentage Crown Closure of Species 5 - 10% classes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	STRUCTURE	In OSCOVER	Text	Stand Structure Flag - M=multistory	M=multistory
temp FLATTABLE; Flat_Table_east; Flat_Table_West	in OSCOVER_ORIGIN	In OSCOVER	Long	10 year Origin class: 2010 adjusted origin	Integer decade values
temp FLATTABLE; Flat_Table_east; Flat_Table_West	TPR_OSCOVER	In OSCOVER	Text	Timber Productivity Rating Uses AVI interpreters' assigned TPR	Null U F M G
temp FLATTABLE; Flat_Table_east; Flat_Table_West	INTERTPR	In OSCOVER	Text	Interpreted TPR Flag from AVI. If the value is 1, then the interpreter has overridden the calculated method	Null = the AVI published calculation methodology is used 1 or I= the AVI photo interpreter over-rode the calculation and assigned the TPR.

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
temp FLATTABLE; Flat_Table_east; Flat_Table_West	NONFORTYPE	In OSCOVER	Text	Non-Forest Type - AVI	NULL = doesn't have a non forest type HF=forbs HG= grasses SC= closed shrub SO=open shrub
temp FLATTABLE; Flat_Table_east; Flat_Table_West	NONFORCL	In OSCOVER	Long	Non-Forest Shrub Closure - 10% Crown Closure Classes for SO & SC Nonfortypes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	ANTHVEG	In OSCOVER	Text	Anthropogenic Vegetated -	NULL A=Annual Crops; P=Perrennial Crops; IP=Industrial Pipeline; IW=Wellsite; IU= Unknown Clearing A
temp FLATTABLE; Flat_Table_east; Flat_Table_West	in OSCOVER_ANTHNONVEG	In OSCOVER	Text	Anthropogenic Non	NULL= not an anthropogenic non veg type IF= Industrial Farm IG= Industrial Gravel IH = Industrial HIghways II= Industrial Plant sites SR = Ribbon Development
temp FLATTABLE; Flat_Table_east; Flat_Table_West	NATNONVEG	In OSCOVER	Text	Natural Non-Vegetated -	NULL= not a naturally non-vegetated site MB= Burn Recent MC= Cutbank MS=Sand WF= Flooded WL=Lakes WR=Rivers
temp FLATTABLE; Flat_Table_east; Flat_Table_West	intBCGRP_OSCOVER	In OSCOVER	Long	Integer Broad Cover Group : 10% Crown Closure Class of Deciduous Species	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	strBCGRP_OSCOVER	In OSCOVER	Text	String Broad Cover Group - C, CD, DC, D	NULL – non forested C - Conifer CD – Conifer leading mixedwood DC – Deciduous leading mixedwood D - Deciduous
temp FLATTABLE; Flat_Table_east; Flat_Table_West	compflag_OSCOVER	In OSCOVER	Text	Composite Flag - used in composite weighting scheme	O = use overstory C= use composite U = use understory
temp FLATTABLE; Flat_Table_east; Flat_Table_West	species group_OSCOVER	In OSCOVER	Text	A Coarse Level classification of leading species	AW AW-FB AW-LT AW-P AW-SB AW-SW BW

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
					BW-FB BW-LT BW-P BW-SB BW-SW FB FB-AW FB-BW FB-PB LT LT-AW LT-BW LT-PB non-treed P P-AW PB PB-FB PB-P PB-SB PB-SW P-BW P-PB SB SB-AW SB-BW SB-PB SW SW-AW SW-BW SW-PB
temp FLATTABLE; Flat_Table_east; Flat_Table_West	REFYEAR	In OSCOVER	Long	Reference Year: Year in which AVI photo was flown	Integer year value: 1997 2003 2004 2006
temp FLATTABLE; Flat_Table_east; Flat_Table_West	MOISTURE_U	In USCOVER	Text	Moisture Regime 'd' , 'a', 'w', 'm' (from table: in USCOVER)	A=aquatic D=dry W=wet M=mesic
temp FLATTABLE; Flat_Table_east; Flat_Table_West	CC_U	In USCOVER	Text	Understorey Crown Closure - 25% classes A, B, C, D	Null A B C D
temp FLATTABLE; Flat_Table_east; Flat_Table_West	HEIGHT_U	In USCOVER	Long	1metre height class	
temp FLATTABLE; Flat_Table_east; Flat_Table_West	S1_U	In USCOVER	Text	Species 1	null Aw Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE;	P1_U	In USCOVER	Long	Percentage Crown	Integer values 0 to 10

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
Flat_Table_east; Flat_Table_West				Closure of Species 1 - 10% classes	
temp FLATTABLE; Flat_Table_east; Flat_Table_West	S2_U	In USCOVER	Text	Species 2	null Aw Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	P2_U	In USCOVER	Long	Percentage Crown Closure of Species 2 - 10% classes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	S3_U	In USCOVER	Text	Species 3	null Aw Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	P3_U	In USCOVER	Long	Percentage Crown Closure of Species 3 - 10% classes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	S4_U	In USCOVER	Text	Species 4	null Aw Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	P4_U	In USCOVER	Long	Percentage Crown Closure of Species 4 - 10% classes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	S5_U	In USCOVER	Text	Species 5	null Aw Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	P5_U	In USCOVER	Long	Percentage Crown Closure of Species 5 - 10% classes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east;	STRUCTURE_U	In USCOVER	Text	Stand Structure Flag - M=multistory	NULL M

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
Flat_Table_West					
temp FLATTABLE; Flat_Table_east; Flat_Table_West	ORIGIN_U	In USCOVER	Long	10 year Origin class assigned by AVI interpreter	Integer values decades
temp FLATTABLE; Flat_Table_east; Flat_Table_West	TPR_U	In USCOVER	Text	Timber Productivity Rating assigned by AVI interpreter	U F M G
temp FLATTABLE; Flat_Table_east; Flat_Table_West	NONFORTYPE_U	In USCOVER	Text	Non-Forest Type - BR, HF, HG, SC, SO	NULL HF HG SC SO
temp FLATTABLE; Flat_Table_east; Flat_Table_West	NONFORCL_U	In USCOVER	Long	Non-Forest Shrub Closure - 10% Crown Closure Classes for SO & SC Nonfortypes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	ANTHVEG_U	In USCOVER	Text	Anthropogenic Vegetated - A=Annual Crops; P=Perrennial Crops; IP=Industrial Pipeline; IW=Wellsite; IU= Unknown Clearing	NULL A=Annual Crops; P=Perrennial Crops; IP=Industrial Pipeline; IW=Wellsite; IU= Unknown Clearing A
temp FLATTABLE; Flat_Table_east; Flat_Table_West	in USCOVER_ANTHNONVEG	In USCOVER	Text	Anthropogenic Non Vegetated -IF, IG, IH, II, IW, SA, SR	NULL IF IG IH II SR
temp FLATTABLE; Flat_Table_east; Flat_Table_West	NATNONVEG_U	In USCOVER	Text	Natural Non-Vegetated - MB, MC, MR, MS, WF, WL, WR	NULL MB MC MS WF WL WR
temp FLATTABLE; Flat_Table_east; Flat_Table_West	intBCGRP_U	In USCOVER	Long	Integer Broad Cover Group : 10% Crown Closure Class of Deciduous Species	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	strBCGRP_U	In USCOVER	Text	String Broad Cover Group - C, CD, DC, D	NULL – non forested C - Conifer CD – Conifer leading mixedwood DC – Deciduous leading mixedwood D - Deciduous
temp FLATTABLE; Flat_Table_east; Flat_Table_West	NONFOREST_U	In USCOVER	Text	NonForest Class - Concatenation of NONFORTYPE, ANTHVEG, ANTHNONVEG, NATNONVEG	NULL BR HG SC SO
temp FLATTABLE;	species group_U	In USCOVER	Text	A Coarse Level classification of leading	AW AW-FB

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
				species	AW-LT AW-P AW-SB AW-SW BW BW-FB BW-LT BW-P BW-SB BW-SW FB FB-AW FB-BW FB-PB LT LT-AW LT-BW LT-PB non-treed P P-AW PB PB-FB PB-P PB-SB PB-SW P-BW P-PB SB SB-AW SB-BW SB-PB SW SW-AW SW-BW SW-PB
temp FLATTABLE; Flat_Table_east; Flat_Table_West	BLK_DET_ID	In CUTOVER SUMMARY Originates in BLK Details Table	Double	Unique identifier assigned to each record in the Blocks Details table (from table: in CUTOVER SUMMARY)	Integer values 1 to 23587
temp FLATTABLE; Flat_Table_east; Flat_Table_West	OPEN_NUM	In CUTOVER SUMMARY	Text	ARIS Opening number	Alphanumeric code
temp FLATTABLE; Flat_Table_east; Flat_Table_West	DISPBLK	In CUTOVER SUMMARY	Text	Disposition Block:Concatenation of disposition and block number	Disposition-Block#
temp FLATTABLE; Flat_Table_east; Flat_Table_West	STOCK_STAT	In CUTOVER SUMMARY	Text	Stocking Status:	NULL CSR= conditional FTG=Free to Grow NSR=not sufficiently stocked PSC=??? SR= sufficiently stocked
temp FLATTABLE; Flat_Table_east;	BLK_CLASS	In CUTOVER SUMMARY	Text	BLOCK CLASS from BLOCKS feature class:	CUT = harvested portion

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
Flat_Table_West		Originates in Blocks feature class		CUT - harvested portion of block; RET- Retention; REM- Removals(only GPSd polys)	REM=removal RET= Retention
temp FLATTABLE; Flat_Table_east; Flat_Table_West	BLK_SOURCE	In CUTOVER SUMMARY	Text	SOURCE from BLOCKS feature class : Where did the spatial data come from? Codes are names of DMI internal data sources	AVI_1 AVI_2 Built GOV GPS LAYOUT ORTHO PHOTO PLAN UPD
temp FLATTABLE; Flat_Table_east; Flat_Table_West	BLK_TYPE	In CUTOVER SUMMARY	Text	BLOCK TYPE: from BLOCKS feature class: Type of block component	FA= Flood GR= Grass I=Internal (applies to retention) LU= LandUse SH=Shrubs UN=UnMerchantable US=UnderStory Protection X= External (applies to retention) TS= Tree Size DE=Density HT=Height TP=Topography
temp FLATTABLE; Flat_Table_east; Flat_Table_West	BLK_TYPE_STAT	In CUTOVER SUMMARY	Text	BLOCK TYPE STATUS from BLOCK feature class:Source of retention/removal data:	P= Planned U= Unplanned
temp FLATTABLE; Flat_Table_east; Flat_Table_West	OP_AREA	In CUTOVER SUMMARY	Text	Operating Area = Cut disposition: License/compartment numbers, MOF flag	Harvest disposition before 2008. DMI operating area after 2008 253 unique values
temp FLATTABLE; Flat_Table_east; Flat_Table_West	BLOCK_ID	In CUTOVER SUMMARY	Text	Number assigned to block when harvested, if known. Only Unique within a license within a timber year	Alphanumeric code
temp FLATTABLE; Flat_Table_east; Flat_Table_West	ARIS_FMU	In CUTOVER SUMMARY	Text	ARIS FMU alphanumeric codes:	P010 P01D P020 P02D P100 P10D P110 P130 P140 P150 P190 P520 P530

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
temp FLATTABLE; Flat_Table_east; Flat_Table_West	DISP_TYPE	In CUTOVER SUMMARY	Text	Disposition Type: Type of disposition such as CTP, CTL, FMA, MOF, LTP. EMEND, FMA,	CTL CTP DTL DTP FMA LTP MOF
temp FLATTABLE; Flat_Table_east; Flat_Table_West	SKID_DATE	In CUTOVER SUMMARY	Date/Time	Date that timber was skid-cleared	Date 1053 unique entries
temp FLATTABLE; Flat_Table_east; Flat_Table_West	SKID_YEAR	In CUTOVER SUMMARY	Double	The 4-digit timber-year that harvesting occurred in. Timber years start May1 and End April 30.	Integer year value SKID_YEAR 1980 1981 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
temp FLATTABLE; Flat_Table_east; Flat_Table_West	SURV_TYPE	In CUTOVER SUMMARY	Text	Survey type conducted (Establishment or Performance): Est Survey; Per Survey	EST SURVEY PER SURVEY NULL
temp FLATTABLE; Flat_Table_east; Flat_Table_West	LBASE_CODE	In CUTOVER SUMMARY	Text	Landbase code as per ARIS Industry Operations Manual, Appendix C - Domain Codes	LBASE_CODE CC CD DD DH DM FP HD HH SC SS
temp FLATTABLE; Flat_Table_east; Flat_Table_West	REGEN_CODE	In CUTOVER SUMMARY	Text	Regeneration code as per ARIS Industry Operations Manual, Appendix C - Domain Codes	 C-2000 CD-2000 CONF D-2000

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
					DC-2000
temp FLATTABLE; Flat_Table_east; Flat_Table_West	CON_VOL	In CUTOVER SUMMARY	Long	Conifer Harvest Volume if known – not used	
temp FLATTABLE; Flat_Table_east; Flat_Table_West	DEC_VOL	In CUTOVER SUMMARY	Long	Deciduous Harvest Volume if known – not used	
temp FLATTABLE; Flat_Table_east; Flat_Table_West	SOURCE_BLK_NUM	In CUTOVER SUMMARY	Text	Source Block Number: Block Numbers provided by source - not always valid but used at times to manually sort out mis-matched records when building BLK Details Table	
temp FLATTABLE; Flat_Table_east; Flat_Table_West	CUTB_SEQ_NBR	In CUTOVER SUMMARY	Long	Cut Block Sequence Number: Source Provided Block 'number' alphanumeric code	1371 unique codes
temp FLATTABLE; Flat_Table_east; Flat_Table_West	HARV_STAT	In CUTOVER SUMMARY	Text	Harvest status- Has it been cut?	Null CUT
temp FLATTABLE; Flat_Table_east; Flat_Table_West	BLK_STATUS	In CUTOVER SUMMARY	Text	BLOCK STATUS from BLOCKS feature class: CUT- block cut and photo confirmed, PLANNED - block laid out with GPS, FUTURE - future block, RET_INT - retention internal to block, RET_EXT - retention external to block (from table: in CUTOVER SUMMARY)	NULL – not used anymore
temp FLATTABLE; Flat_Table_east; Flat_Table_West	HARV_YEAR	In CUTOVER SUMMARY	Long	HARVEST YEAR: DMI manual assignment of harvest year from many sources from BLOCKS feature class	Integer year values
temp FLATTABLE; Flat_Table_east; Flat_Table_West	RETREAT	In CUTOVER SUMMARY	Text	ARIS flag for NSR CSR stands requiring retreatments	NULL RTD
temp FLATTABLE; Flat_Table_east; Flat_Table_West	OP_REF_RES	In CUTOVER SUMMARY	Text	OPERATOR with REFORESTATION RESPONSIBILITIES	NULL= unknown BCHE= Buchannan CBVA=CBVAC CFPL= Canfor DAIS= DMI ZAVI+ Zavisha
temp FLATTABLE; Flat_Table_east;	TOT_STOCK	In CUTOVER SUMMARY	Long	ARIS Total Stocking Percentage	Integer value from 0 to 100

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
Flat_Table_West					
temp FLATTABLE; Flat_Table_east; Flat_Table_West	cPOST91	In CUTOVER SUMMARY	Long	CALCULATED POST91 FLAG: Is this record Post 91? Yes or No	0=not a post91 block 1= this is a post91 block
temp FLATTABLE; Flat_Table_east; Flat_Table_West	cPRE91	In CUTOVER SUMMARY	Long	PRE91 block? : 1 = yes, 0 = no	0= not a Pre91 block 1 = it is a Pre91 block
temp FLATTABLE; Flat_Table_east; Flat_Table_West	cPOST08	In CUTOVER SUMMARY	Long	POST 2008 block?: 1 = yes, 0 = no These are flagged because they are viewed as pre-scheduled in the TSA	0= not a Post08 block 1 = it is a Post08 block
temp FLATTABLE; Flat_Table_east; Flat_Table_West	cARIS_LINK	In CUTOVER SUMMARY	Long	CALCULATED ARIS LINK: Does this record have an ARIS Record? Yes or No	0=no link to ARIS 1= Has a ARIS opening number
temp FLATTABLE; Flat_Table_east; Flat_Table_West	cCUT_TYPE	In CUTOVER SUMMARY	Long	CALCULATED CUT TYPE: 1 - 8	NULL – not used anymore
temp FLATTABLE; Flat_Table_east; Flat_Table_West	cARIS_AGE FLAG	In CUTOVER SUMMARY	Long	CALCULATED ARIS AGE FLAG: Does this record have an ARIS skid timber year? 1= yes; 0 = no	0 = no link to an ARIS skid timber year 1 = has an ARIS skid timber year
temp FLATTABLE; Flat_Table_east; Flat_Table_West	cHARVEST YEAR FLAG	In CUTOVER SUMMARY	Long	CALCULATED HARVEST YEAR: DMI manual assignment of harvest year from many sources: 1 = yes; 0 = no	0=no assignment 1= used the harv_year for aging
temp FLATTABLE; Flat_Table_east; Flat_Table_West	cAVI AGE FLAG	In CUTOVER SUMMARY	Long	CALCULATED AVI AGE FLAG: Use AVI origin. 1 = yes; 0= no	0 = did not flag to use AVI for aging 1 = did use avi for aging
temp FLATTABLE; Flat_Table_east; Flat_Table_West	cAVI Strat FLAG	In CUTOVER SUMMARY	Long	CALCULATED AVI STRATIFICATION FLAG: 1 = yes; 0=no	0 = did not use AVI for stratification of yield curve 1= did use AVI to assign yield curve
temp FLATTABLE; Flat_Table_east; Flat_Table_West	in CUTOVER SUMMARY_ASSIGNED YC	In CUTOVER SUMMARY	Long	ASSIGNED PATHWAY: G&Y 2011 valid pathways	Integer value from 1 to 12 assigned if a yield curve decision was made during the cutover summary processing
temp FLATTABLE; Flat_Table_east; Flat_Table_West	ASSIGNED AGE(YEARS)	In CUTOVER SUMMARY	Long	ASSIGNED AGE: Age(years) assigned by stratification routine	Integer year value assigned if an age decision was made during the cutover summary processing

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
temp FLATTABLE; Flat_Table_east; Flat_Table_West	ASSIGNED TREATMENT	In CUTOVER SUMMARY	Long	Assigned Treatment: For prescheduled blocks in Woodstock model. Harvest treatment code	0= no treatment assigned 1= generic place holder assigned meaning harvest
temp FLATTABLE; Flat_Table_east; Flat_Table_West	ASSIGNED TREATMENT YEAR	In CUTOVER SUMMARY	Long	Assigned Treatment year: For prescheduled blocks in Woodstock Model. Future harvest year if known. Forces the model to 'catch up' to known harvests that have occurred since May1 2009.	0 2009 2010
temp FLATTABLE; Flat_Table_east; Flat_Table_West	ASSIGNED LBASE	In CUTOVER SUMMARY	Text	Assigned Lbase based on strata declaration and FMU	NULL: not assigned LC: conifer lbase LD: deciduous lbase NA: non forest anthropogenic NN: non forest natural VN: vegetated non-forest
temp FLATTABLE; Flat_Table_east; Flat_Table_West	REGEN CODE	In DECLARED STRATA	Text	Declared Stratum C, CD, DC, D (from table: in DECLARED STRATA)	C-2000 CD-2000 CONIFER D-2000 DC-2000 PR91 XX
temp FLATTABLE; Flat_Table_east; Flat_Table_West	in DECLARED STRATA_ASSIGNED YC	In DECLARED STRATA	Long	G&Y2011 PATHWAY (from table: in DECLARED STRATA)	-1 = NON FOREST 0 = NON PRODUCTIVE 1 = DECIDUOUS 3= DC 4= CD 6 = CONIFER
temp FLATTABLE; Flat_Table_east; Flat_Table_West	BLOCKS_KEY	IN COMPOSITE FOREST WEST Originates in Blocks feature class	Double	Unique identifier of record from blocks input feature class (from table:temp COMPOSITE FOREST)	Integer value
temp FLATTABLE;	VI1_POLYID	IN COMPOSITE FOREST WEST Originates in Blocks feature class	Double	Unique polygon ID - Link into old Vegetation Inventory (AVI1) attributes (only within cutblocks) Before disallowed by ASRD, this was used to stratify cuts by using knowledge of what was cut.	Integer value
temp FLATTABLE; Flat_Table_east; Flat_Table_West	GRAZING_KEY	IN COMPOSITE FOREST WEST	Double	Unique identifier of record from Grazing input feature class	Integer value

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
temp FLATTABLE; Flat_Table_east; Flat_Table_West	PARK_KEY	IN COMPOSITE FOREST WEST	Double	Unique identifier of record from Parks input feature class	Integer value
temp FLATTABLE; Flat_Table_east; Flat_Table_West	FMA	IN COMPOSITE FOREST WEST	Double	FMA flag: 0 - not within the FMA, 1 - within the FMA	0 = not in FMA 1 = inside fma
temp FLATTABLE; Flat_Table_east; Flat_Table_West	COMPARTMENT	IN COMPOSITE FOREST WEST	Text	DMI Compartment name/number	NOT POPULATED IN THIS SUBMISSION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	TRAPNO	IN COMPOSITE FOREST WEST	Text	Trap line number (provincial unique identifier)	NOT POPULATED IN THIS SUBMISSION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	ZONENUM	IN COMPOSITE FOREST WEST	Text	Number assigned to each compartment (cost zone). Only unique within one sustainable yield unit	NOT POPULATED IN THIS SUBMISSION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	ZONENAME	IN COMPOSITE FOREST WEST	Text	Name assigned to each compartment (cost zone). If no name assigned, the name corresponds to the zone number.	NOT POPULATED IN THIS SUBMISSION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	CARIBOU	IN COMPOSITE FOREST WEST	Double	Caribou range flag	0 = Not inside ASRD supplied boundary of Nov 2010 1 = Inside ASRD supplied boundary of Nov 2010
temp FLATTABLE; Flat_Table_east; Flat_Table_West	TEARDROP	IN COMPOSITE FOREST WEST	Double	Lubicon traditional area flag as follows:	Not applicable on west fma
temp FLATTABLE; Flat_Table_east; Flat_Table_West	FMADEL	IN COMPOSITE FOREST WEST	Text	Appendix “A” deletions as follows:	0 or null = not a deletion 1 = FMA deletion
temp FLATTABLE; Flat_Table_east; Flat_Table_West	IRTAG	IN COMPOSITE FOREST WEST	Text	Native Reserves within the Appendix A deletions as follows:	0 or null = not an Indian Reserve deletion 1 = it is an Indian Reserve Deletion
temp FLATTABLE; Flat_Table_east; Flat_Table_West	GRAZING	IN COMPOSITE FOREST WEST	Double	Grazing range flag: (No harvest restriction on this type)	0 – not within Grazing range 1 – within Grazing range
temp FLATTABLE; Flat_Table_east; Flat_Table_West	BREAK	IN COMPOSITE FOREST WEST	Double	Area of topographic concern as follows:	1 – area within incised valleys 2 – area of rugged terrain 3 – area too steep to operate

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
temp FLATTABLE; Flat_Table_east; Flat_Table_West	hydrobuf	IN COMPOSITE FOREST WEST	Text	Flag of area buffered around each hydrographic type	LAKE LRG_PERM SM_PERM SWAN
temp FLATTABLE; Flat_Table_east; Flat_Table_West	FIRENUM	IN COMPOSITE FOREST WEST	Text	Unique name assigned to each fire, "typically" of the form AAA-BBB-YYYY (eg. PWF-042-2002) where:	Alphanumeric code AAA is the LFS Area Identifier BBB is the 3-digit fire sequence num in the LFS Area YYYY is the 4-digit year it occurred. (sometimes 2-digit)
temp FLATTABLE; Flat_Table_east; Flat_Table_West	FIREYEAR	IN COMPOSITE FOREST WEST	Double	The 4-digit year during which the fire occurred.	Integer year value 0 2003 2004 2005 2006 2007 2008 2009
temp FLATTABLE; Flat_Table_east; Flat_Table_West	LU FLAG	IN COMPOSITE FOREST WEST	Long	Binary flag indicating other disturbances, mainly due to oil-and-gas activity	0 = not a land use deletion 1 = this is a land use deletion
temp FLATTABLE; Flat_Table_east; Flat_Table_West	MOOSE	IN COMPOSITE FOREST WEST	Double	Moose range flag as follows:	0 = not within moose zone 1 = within river valley zone 2 = within upland zone
temp FLATTABLE; Flat_Table_east; Flat_Table_West	NATURAL	IN COMPOSITE FOREST WEST	Text	Natural sub-regions:	CMW DMW LBH UBH
temp FLATTABLE; Flat_Table_east; Flat_Table_West	WAM	IN COMPOSITE FOREST WEST	Text	Wet Area Mapping based on the depth of the water table: 1 - 0.00 to 0.10m, 2 - 0.10 to 0.25m, 3 - 0.25 to 0.50m, 4 - 0.50 to 1.00m	NOT POPULATED IN THIS SUBMISSION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	RESERVATION	IN COMPOSITE FOREST WEST	Text	Area with timber harvesting restriction	EMEND MWMA NIVMA PNT050181 PSP1990 PSP2005 PSPGOV REC840008 REC890026 REC950006 TSP1999 TSP2005 WESBOGY
temp FLATTABLE; Flat_Table_east;	MPB_SR	IN COMPOSITE FOREST WEST	Text	Mountain Pine Beetle Susceptibility Rating	NOT POPULATED IN THIS SUBMISSION

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
Flat_Table_West					
temp FLATTABLE; Flat_Table_east; Flat_Table_West	FIRENUMBER	IN COMPOSITE FOREST WEST	Text	Firenumber from input feature class fires	NOT POPULATED IN THIS SUBMISSION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	LUCLASS	IN COMPOSITE FOREST WEST	Text	land use class value	Highway Industrial Major Road Minor Road Pipeline Railroad Road Utility Wellsite
temp FLATTABLE; Flat_Table_east; Flat_Table_West	CRN	IN COMPOSITE FOREST WEST	Double	Continuous reserve network value	NOT POPULATED IN THIS SUBMISSION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	Shape_LengTH	IN COMPOSITE FOREST WEST	Double	Shapefile autogenerated polygon perimeter in metres	Decimal number
temp FLATTABLE; Flat_Table_east; Flat_Table_West	SHAPE_Area	IN COMPOSITE FOREST WEST	Double	Shapefile autogenerated polygon area in metres squared	Decimal number
temp FLATTABLE; Flat_Table_east; Flat_Table_West	COST2D_DEC	HAUL_COSTS	Text	$2 CYCLE HAUL COST TO DMI	Integer value
temp FLATTABLE; Flat_Table_east; Flat_Table_West	COST2D_CON	HAUL_COSTS	Text	$2 CYCLE HAUL TO APPROPRIATE SAWMILL (HIGH LEVEL IN vsa1; HINES CREEK IN vsa2)	Integer value Not populated on East FMA
temp FLATTABLE; Flat_Table_east; Flat_Table_West	BLK_UPD_NON_RET_AREA_HA	BLK_DETAILS	Double	Area of cut portions (non-retention) of blocks in ha	Decimal number
temp FLATTABLE; Flat_Table_east; Flat_Table_West	DECD_COND_STOCK	In CUTOVER SUMMARY	Double	Deciduous conditional stocking from ARIS	Decimal number between 0 an 100
temp FLATTABLE; Flat_Table_east; Flat_Table_West	DECD_ACC_STOCK	In CUTOVER SUMMARY	Double	Deciduous acceptable stocking from ARIS	Decimal number between 0 an 100
temp FLATTABLE; Flat_Table_east; Flat_Table_West	CONF_COND_STOCK	In CUTOVER SUMMARY	Double	Conifer conditional stocking from ARIS	Decimal number between 0 an 100
temp FLATTABLE; Flat_Table_east;	CONF_ACC_STOCK	In CUTOVER SUMMARY	Double	Conifer acceptable stocking from ARIS	Decimal number between 0 an 100

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
Flat_Table_West					
temp FLATTABLE; Flat_Table_east; Flat_Table_West	ORIGINAL_DECLARATION	In CUTOVER SUMMARY	Text	First declaration made in ARIS	C CD CD-2000 D DC DC-2000
temp FLATTABLE; Flat_Table_east; Flat_Table_West	PLANT_SPECIES	In CUTOVER SUMMARY	Text	Pine vs Spruce flag provided by operator	Pine Spruce NOT PROVIDED IN TIME FOR THIS SUBMISSION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	HARV_AREA_HA	In CUTOVER SUMMARY	Double	ARIS declared harvest area in ha	Decimal number
temp FLATTABLE; Flat_Table_east; Flat_Table_West	CUT ASSIGNED BCGRP	In DECLARED STRATA	Text	Assigned broad cover group from ARIS reconciliation	C CD D DC ERROR
temp FLATTABLE; Flat_Table_east; Flat_Table_West	INTERTPR_U		Text	Understory Interpreted TPR flag: Denotes if the interpreter over-rode the calculated TPR and supplied an interpreted TPR.	Null: AVI calculated TPR used I = Interpreted TPR used
temp FLATTABLE; Flat_Table_east; Flat_Table_West	MOD1_MODIFIER		Text	Ostory Mod1 modifier	AD BU CC OC SN WF
temp FLATTABLE; Flat_Table_east; Flat_Table_West	MOD1_EXTENT		Text	Ostory Mod1 Extent	1 2 3 4 5
temp FLATTABLE; Flat_Table_east; Flat_Table_West	MOD1_YEAR		Text	Ostory Mod1 Year	Integer year value
temp FLATTABLE; Flat_Table_east; Flat_Table_West	MOD2_MODIFIER		Text	Ostory Mod2 Modifier	AD BU CC OC SN WF
temp FLATTABLE; Flat_Table_east; Flat_Table_West	MOD2_EXTENT		Text	Ostory Mod2 Extent	1 2 3 4 5
temp FLATTABLE; Flat_Table_east;	MOD2_YEAR		Text	Ostory Mod2 Year	Integer year value

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
Flat_Table_West					
Flat_Table_east Flat_table_west	Interpreted_Origin	Origin_adjust_west Origin_adjust_east	Long Integer	AVI 10 year Origin class assigned by AVI interpreter: This is the one that was changed in 2010 adjustment	Integer 10 year decade class
Flat_Table_east Flat_table_west	Modified_Origin	Origin_adjust_west Origin_adjust_east	Long Integer	ORIGIN 10 year class derived from 2010 adjustment: This is the one used as "ORIGIN" in yields and net landbase.	Integer 10 year decade class
Flat_Table_east Flat_table_west	Interpreted_TPR	Origin_adjust_west Origin_adjust_east	TEXT	Overstory Timber Productivity Rating calculated using interpreted origin: Only populated for polys within scope of origin adjustment:	<NULL>=wasn't part of adjustment; U=Unmerch; F=Fair; M=Medium; G=Good
Flat_Table_east Flat_table_west	Recalculated_TPR	Origin_adjust_west Origin_adjust_east	Text	Overstory Timber Productivity Rating calculated using the modified origin: Only populated within scope of adjusted origin:	<NULL>=wasn't part of adjustment; U=Unmerch; F=Fair; M=Medium; G=Good
Flat_Table_east Flat_table_west	ORIGIN_calc_FLAG	Origin_adjust_west Origin_adjust_east	Long Integer	FLAG that denotes the record had a origin adjustment 2010 calc performed on it.	0 or null =polygon was not part of the adjustment2010 calculation; 1=polygon had an origin calculated during theadjustment2010 process
Flat_Table_east Flat_table_west	ORIGIN_change_FLAG	Origin_adjust_west Origin_adjust_east		FLAG that denotes whether the record:was changed during the origin adjustment 2010 calculation.	-1 or null = was not part of adjustment2010 calculation; 0 = adjustment2010 gave same origin as interpreted; 1 = adjustment2010 gave a different origin (ie the origin was modified)

15 UPDATING OF THE WEST SHAPEFILE

Woodstock Themes, age and prescheduling information are added to the WEST shapefile. The shapefile “westfma_apr28.shp” is the starting product for all modelling on FMA West. All information required for modeling is present in the output table MODEL FOREST.

The table MODEL FOREST will be related to the shapefile attribute table westfma_apr28.dbf using a one-to-one relate on the field CMPKEY. The following fields are updated in the shape file attribute table with the values from MODEL FOREST:

- THEME1, THEME2, THEME3, THEME4, THEME5, THEME6
- AGE (update with AGE(10) for 10 year periods)
- PREBLOCK
- ACTION
- CUT_PERIOD

An actual sample query is not submitted here as relative pathing is required – the reviewer may opt to do this step in MS-Access or in ARCMap.

Field Name	Type	Description/Values
CMPKEY	Num	Unique key assigned to each composite forest polygon.
PID	Num	Polygon identifier: unique to an interpreted polygon within a township, from 1 to 9999.
MER	Num	Meridian: 5-6
TWP	Num	Township: 82-103
RGE	Num	Range: 1-26
CUTKEY07	Num	Unique identifier assigned to each polygon in the cutovers coverage.
CATCHKEY	Num	Unique identifier assigned to each polygon in the gauging-station catchment coverage.
ZONENUM	Num	Number assigned to each compartment (cost zone). Only unique within one sustainable yield unit

Field Name	Type	Description/Values
ZONENAME	Char	Name assigned to each compartment (cost zone). If no name assigned, the name corresponds to the zone number.
CARIBOU	Num	Caribou range flag as follows: 0 – not within caribou range 1 – within caribou range
TEARDROP	Num	Lubicon traditional area flag as follows: 0 – not within teardrop 1 – within teardrop
FMADEL	Num	Appendix “A” deletions as follows: 0 – not an Appendix “A” deletion 1 – Appendix “A” deletion
IRTAG	Char	Native Reserves within the Appendix A deletions as follows: LUB – Lubicon LCA SET – Settlement areas adjacent to reserves WC – Woodland Cree IR
BREAK	Num	Area of topographic concern as follows: 1 – area within incised valleys 2 – area of rugged terrain 3 – area too steep to operate
HYDROBUF	Char	Flag of area buffered around each hydrographic type as follows: null – non-buffer island polygon SWAN – 200m around swan nesting sites LAKE – 100m around lakes LRG_PERM – 60m around double-lined river polygons SM_PERM – 32m along small permanent streams (the additional 2m allows for an average channel width of 4m.)

Field Name	Type	Description/Values
FIRENUM	Char	Unique name assigned to each fire, “typically” of the form AAA-BBB-YYYY (eg. PWF-042-2002) where: AAA is the LFS Area Identifier, BBB is the 3-digit fire sequence num in the LFS Area, and YYYY is the 4-digit year it occurred. (sometimes 2-digit)
FIREYEAR	Num	The 4-digit year during which the fire occurred. 0, 1980, 1981, …2002
LINEBUF	Num	Binary flag indicating other disturbances, mainly due to oil-and-gas activity; 0 – no disturbance, or 1 – disturbance.
AREAha	Num	Area in hectare of each composite forest polygon
VI1_POLYID	Num	Unique polygon ID - Link into old Vegetation Inventory (AVI1) attributes (only within cutblocks)
TREEDAREAHA	Num	Area in Hectares of each composite forest polygon minus any overlapping seismic disturbance (seismic line buffered by 5m)
NATURAL	Char	Natural sub-regions: CMW - Central Mixed Wood DMW - Dry Mixed wood LBH - Lower Boreal Highlands UBH - Upper Boreal Highlands
WAM	Num	Wet Area Mapping based on the depth of the water table: 1 - 0.00 to 0.10m 2 - 0.10 to 0.25m 3 - 0.25 to 0.50m 4 - 0.50 to 1.00m
MOOSE	Num	Moose range flag as follows: 0 – not within moose zone, 1 – within River Valley moose zone, 2 - within Upland moose zone

Field Name	Type	Description/Values
GRAZING	Num	Grazing range flag as follows: 0 – not within Grazing area, 1 – within Grazing area
POLYID	Num	Unique polygon ID - Link into vegetation Inventory attributes
BLK_STATUS	Char	Block Status: CUT- block cut and photo confirmed PLANNED - block laid out with GPS FUTURE - future block RET_INT - retention internal to block RET_EXT - retention external to block
OP_AREA	Char	Operating Areas
DISPOSITIO	Char	Cut Disposition - License & Compartment numbers, MOF flag etc
BLOCK	Num	Cut Block Number (if known)
BLK_YEAR	Num	Cut Season (4 digit year corresponds to FALL start date)
BLK_DET_ID	Num	Unique identifier assigned to each polygon in the cutblock layer.
DISPO_TYPE	Char	Disposition type (CTL, CTP, FMA, DTL, EMEND, LTP, MOF)
RESERVATION	Char	Area with timber harvesting restriction EMEEND: EMEND research area MWMA: Mixedwood Management Association research plots NIVMA: NIVMA research plot/block PNTxxxxxx: Protective Notation PSP1990: DMI ‘s 1990 Permanent Sample Plot PSP2005: DMI ‘s 2006-2008 Permanent Sample Plot PSPGOV: Government Permanent Sample Plot RECxxxxxx: Recreational Area TSP1999: DMI 1999 Temporary Sample Plot TSP2005: DMI 2005 Temporary Sample Plot WESBOGY: WESBOGY sample plot

Field Name	Type	Description/Values
THEME1	Char	THEME STRATUM 0 – No Strata 1 – Aspen >> Shrub 2 – Aspen >> White spruce 3 – Aspen >> Late Mixed >> White spruce 4 – Aspen >> Early Mixed >> White spruce 5 – Mixed >> White spruce 6 – White spruce >> White spruce 7 – Pine 8 – Pine-Black spruce-Hardwood 9 – Deciduous-Pine-BlackSpruce 10 – Pine-WhiteSpruce 11 – Balsam poplar 12 – BlackSpruce-Pine/Whitespruce 13– BlackSpruce
THEME2	Char	THEME LBASE LCIN – ACCESSIBLE TIMBER IN THE CONIFER LANDBASE LDIN – ACCESSIBLE TIMBER IN THE DECIDUOUS LANDBASE LCSEN –CONIFER LANDBASE IN RUGGED TERRAIN LDSEN –DECIDUOUS LANDBASE IN RUGGED TERRAIN LE – EMEND SITE OTHER – BUFFERS, DELETIONS, NONTIMBER, UNPRODUCTIVE

Field Name	Type	Description/Values
THEME3	Char	THEME STATE NAT – NATURAL SITES MAN – MANAGED SITES OTHER – OTHERS BURN – FIRES RET- Retention Patches LINEAR – LINEAR DELETIONS
THEME4	Char	THEME FMU P10 P11 P1N P1S P2
THEME5	Char	THEME Mountain Pine Beetle Stand Susceptibility
THEME6	Char	THEME COST ZONES D##C##
AGE	Num	10-YEAR Age class used in Woodstock
PREBLOCK	Char	Preschedule Flag for Woodstock Yes No
ACTION	Num	Action code 1 - Harvest 0
CUT_PERIOD	Num	Cut Period for Woodstock

16 AVI APPROVAL LETTERS

16.1 AVI APPROVAL LETTER FOR P4

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

RECEIVED
JUL 2 8 2008
WOODLANDS

Government of Alberta
2001 & 2002 IPAC *Gold Award* for Innovative Management

Finance and Administration
Resource Information Management Branch
14th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, AB T5K 2J6
Telephone: (780) 427-6467
Fax: (780) 422-0712

July 21, 2008

Ms. Joanne Smirl
Daishowa-Marubeni International Ltd.
Peace River Pulp Division
Postal Bag 6500
Pulp Mill Site
Peace River, Alberta
T8S 1V5

Dear Ms. Smirl:

Please find enclosed the final audit report for the Alberta Vegetation Inventory completed by Daishowa-Marubeni International Ltd. within forest management unit P4 of the associated forest management agreement area. The data have successfully passed an audit by Resource Information Management Branch.

If you have any questions regarding this process, please feel free to contact Alberto Parry at (780) 422-0977.

Sincerely,

Craig Barnes, Executive Director
Resource Information Management Branch

c: Doug Sklar, Executive Director
Forest Management Branch

Keith Lyseng, Acting Executive Director
Forest Protection Branch

16.2 AVI APPROVAL LETTER FOR P5

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

Government of Alberta
2001 & 2002 IPAC Gold Award for Innovative Management

Finance and Administration
Resource Information Management Branch
14th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, AB T5K 2J6
Telephone: (780) 427-6467
Fax: (780) 422-0712

May 8, 2008

Ms. Joanne Smirl
Daishowa-Marubeni International Ltd.
Peace River Pulp Division
Postal Bag 6500
Pulp Mill Site
Peace River, Alberta
T8S 1V5

RECEIVED
MAY 13 2008
WOODLANDS

Dear Ms. Smirl:

Please find enclosed the final audit report for the Alberta Vegetation Inventory completed by Daishowa-Marubeni International Ltd. within forest management unit P5 of the associated forest management agreement area. The data have successfully passed an audit by Resource Information Management Branch.

If you have any questions regarding this process, please feel free to contact Alberto Parry at (780) 422-0977.

Sincerely,

for Craig Barnes

Craig Barnes, Executive Director
Resource Information Management Branch

c: Doug Sklar, Executive Director
Forest Management Branch

Don Harrison, Executive Director
Forest Protection Branch

16.3 AVI APPROVAL LETTER FOR P3

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

RECEIVED
JAN 0 2 2008
WOODLANDS

Resource Information Management Branch
14th Floor, 9820 - 106 Street
Edmonton AB T5K 2J6
Telephone 780-427-6467
Fax 780-422-0712

December 11, 2007

Ms. Joanne Smirl
Daishowa-Marubeni International Ltd.
Peace River Pulp Division
Postal Bag 6500
Pulp Mill Site
Peace River, Alberta
T8S 1V5

Dear Ms. Smirl:

Please find enclosed the final audit report for the Alberta Vegetation Inventory (AVI) completed by Daishowa-Marubeni International Ltd. in forest management unit P3. The data have successfully passed an audit by Resource Information Management Branch.

If you have any questions regarding this process, please feel free to contact Alberto Parry at (780) 422-0977.

Sincerely,

Craig Barnes, Executive Director
Resource Information Management Branch

c: Doug Sklar, Executive Director
Forest Management Branch

Don Harrison, Executive Director
Forest Protection Branch

16.4 AVI APPROVAL LETTER FOR P10

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

Resource Information Management Branch
12th Floor, 9820 - 106 Street
Edmonton AB T5K 2J6
Telephone 780-427-6467
Fax 780-427-1215

RECEIVED
OCT 07 2005
WOODLANDS

October 3, 2005

Ms. Joanne Smirl
Daishowa-Marubeni International Ltd.
Peace River Pulp Division
Postal Bag 6500
Pulp Mill Site
Peace River, Alberta
T8S 1V5

Dear Ms. Smirl:

Alberta Sustainable Resource Development staff completed a review of the Alberta Vegetation Inventory (AVI) completed by Daishowa-Marubeni International Ltd. for forest management unit P10. The data have successfully passed an audit by Resource Information Management Branch. I am enclosing the final audit report.

If you have any questions regarding this process, please feel free to contact Daryl McEwan at (780) 415-0010.

Sincerely,

Craig Barnes, Executive Director
Resource Information Management Branch

c: Doug Sklar, Executive Director
Forest Management Branch

Don Harrison, Director
Wildlife Service Branch

16.5 AVI APPROVAL LETTER FOR P13

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

Resource Information Management Branch
12th Floor, 9820 - 106 Street
Edmonton AB T5K 2J6
Telephone 780-427-6467
Fax 780-427-1215

RECEIVED
AUG 29 2005
WOODLANDS

August 22, 2005

Ms. Joanne Smirl
Daishowa-Marubeni International Ltd.
Peace River Pulp Division
Postal Bag 6500
Pulp Mill Site
Peace River, Alberta
T8S 1V5

Dear Ms. Smirl:

Alberta Sustainable Resource Development staff completed a review of the Alberta Vegetation Inventory (AVI) completed by Daishowa-Marubeni International Ltd. for forest management unit P13 (formerly known as FMUs P1D and P2D). The data have successfully passed an audit by Resource Information Management Branch. I am enclosing the final audit report.

If you have any questions regarding this process, please feel free to contact Daryl McEwan at (780) 415-0010.

Sincerely,

Craig Barnes, Executive Director
Resource Information Management Branch

c: Doug Sklar, Executive Director
Forest Management Branch

Don Harrison, Director
Wildlife Service Branch

16.6 AVI APPROVAL LETTER FOR P1 (P1N)

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

RECEIVED
JUN 23 2004
WOODLANDS

Resource Data Branch

12th Floor, 9820 - 106 Street
Edmonton AB T5K 2J6

Telephone 780-427-6467
Fax 780-427-1215

June 18, 2004

Ms. Joanne Smirl
Daishowa-Marubeni International Ltd.
c/o Peace River Pulp Division
Postal Bag 6500
Peace River, AB
T8S 1V5

Dear Ms. Smirl: Joanne

Alberta Sustainable Resource Development staff completed a review of the Alberta Vegetation Inventory data submitted for the area included in forest management unit P1. The data successfully met all audit requirements requested by SRD. The final audit report will be completed in the near future.

If you have any questions regarding this process, please feel free to contact Daryl McEwan at (780) 415-0010.

Sincerely,

Phil Mackenzie P. Eng., Acting Director
Resource Data Branch

c: Doug Sklar, Executive Director
Forest Management Branch

Don Harrison, Director
Wildfire Service Branch

17 APPROVAL CONDITIONS BACKGROUND

17.1 WEST FMA FIRST NET LANDBASE SUBMISSION

The net landbase documentation for FMA0900045 (FMA West) was first submitted in 2010. In May of 2010, as the forecasting document was being reviewed by the Plan Development Team, a possible problem was detected with the aging of the new AVI. The apparent change in ages (as compared to previous inventories) resulted in a much younger and a much more productive forest than past DFMPs suggested. It was mutually agreed upon by ASRD and DMI that the resultant AACs were risky until the aging issue was explainable.

The AVI ages were adjusted to match the 1989 origins and all work (net land base, yield forecasts, and forecasting) was replicated.

17.2 WEST FMA SECOND NET LAND BASE SUBMISSION

The Net Landbase Submission for FMA0900045 (west) was submitted on February 3, 2011. ASRD and DMI agreed that the west fma would be reviewed before the east fma would be submitted.

ASRD responded with a letter on April 1, 2011 (ASRD file #06298-F02-04) listing 14 points that required changes. The letter is attached as an appendix.

17.3 WEST FMA THIRD NET LANDBASE SUBMISSION

The Net Landbase Submission for FMA0900045 (FMA West) was submitted on August 15, 2011. This third submission contained all 14 amendments requested by ASRD in the April 1, 2011 letter.

The submission letter explaining the 14 points is presented as an appendix.

17.4 EAST FMA NET LANDBASE SUBMISSION

The Net Landbase Submission for FMA0900044 (FMA East) was submitted on August 23, 2011. This submission followed exactly the methodology used in the third West FMA net land base submission including the same treatment of the 14 points from the April1, 2011 ASRD letter.

17.5 YIELD CURVE SUBMISSION

The growth and yield program was designed and approved before the DMI FMA8900027 was split into two FMAs. The analysis was completed as a single piece of work to be applied to both new FMAs.

Following the 2010 review, ASRD requested that separate sets of yield curves be built for the east and west FMAs. The work was completed as one body of work that used indicator variable approach to produce two sets of curves. Therefore, there is one document covering Growth & Yield analysis for two FMAs. The exact same document is inserted into both DFMP submissions.

The Growth & Yield Information Package 2011 was submitted on September 14, 2011.

18 YIELD CURVE AND NET LAND BASE REVIEW CONDITIONS

ASRD responded to the west FMA net land base, east FMA net land base, and yield curve submissions in a letter dated November 24, 2011 (ASRD file# 06298-R01-01).

The content of that letter is paraphrased below with the response to each item.

18.1 YIELD CURVE REVIEW

"The department has completed its review of the Growth and Yield Information Package 2011 dated September 13, 2011. In general the documentation and procedures are consistent with discussions held with Daishowa-Marubeni International Ltd. (DMI) regarding planned localization of East Forest Management Agreement (FMA) versus West FMA yield estimates. The department was unable to replicate the steps taken with the data provided.

The findings are as follow: Yield Estimates"

Each item has been addressed and a new version of the growth and yield information package is submitted. Each of the items is also explained within the yield document.

1) Interpreted Alberta Vegetation Inventory (AVI) attribute data and resulting stratum assignment are not provided linked to the plot data. Origin and age were absent from the plot data.

Action: Resubmit data with interpreted AVI attributes, original origin, and modified origin attached.

DMI Reply: The requested data was present in the original submission but not clearly explained. We have determined that the correct data was used. The yield submission is amended to point out the requested data items. There is a net landbase amended flat table containing the requested data items.

2) Adjusted or modified AVI age is not documented in the "Growth and Yield Information Package 2011" (September 13, 2011). The stand origin field is referenced as AEP1991 but the data is not included.

Action: Document how modified origins/ages were used. Maintain the original and modified origins in the data.

DMI Reply: This is the same issue as #1. The yield curve submission explains the three requested data items. The new net landbase submissions contain appendix sections that explain where to find the requested items in the AVI tables and the flat table.

3) Data references 2007/2010 Microsoft Access format (i.e. .accdb), contrary to references made on page 7 and page 10 of the information package (i.e. .mdb).

Action: Editorial.

DMI Reply: Fixed in the new growth and yield information package.

4) Stratification description (page 21) is not consistent with SAS code. To align with stratification SAS coding (i.e. 04-019 STEP 5 -STRATIFICATION v2.sas), step 8, section 3.1.1 Landbase Criteria should read: "8. Succession Group: Forest stand that did not have a significant proportion of pine black spruce or Larch, OR that has a overstory broad cover group of "D" (i.e. [NF=0 and PXSBLT<=20% and uPXSBLT<=40%] OR (BCGo="D"].)

Action: Editorial. Verify interpretation is correct and update document.

DMI Reply: It has been verified that the interpretation is correct – The wording has been changed to better reflect what was done.

5) Stratification description table 5 (page 22) for DU1, DU2 and DU3 are not consistent with the SAS coding (i.e. 04-019 STEP 5 -STRATIFICATION v2.sas). The reference "...at least 'A' density conifer tree species in the understory..." should read "...any presence identified in the understory layer of shade tolerant conifers (i.e. Fb, Sw and Sb)..." .

Action: Editorial. Verify interpretation is correct and update document. Review stratification description to ensure description and the coding are correct.

DMI response: The 'A' density term is used to denote that at least 6% shade-tolerant understory (AVI 2.1 specs.). The term 'any presence' would indicate shade-tolerant understorey between 1-6% cover could occur and is not the case. The wording in the new yield document is changed to "at least 6%" instead of " 'A' density" to avoid future confusion.

6) Reforestation Standard of Alberta (RSA) Mean Annual Increment (MAI) targets are not included in the Information Package.

Action: Include RSA MAI targets in the completed Forest Management Plan (FMP). Contact Lee Martins and Darren Aitkin to verify targets are properly defined prior to FMP completion.

DMI Response: The RSA MAI targets are submitted in a separate document. Darren Aitken was consulted prior to developing the submitted tables.

7) There are a number of broken reference links and tabular formatting issues in the information package: for example on pages 22, 25, 26.

Action: Editorial.

DMI Response: Fixed in new document.

8) The graph or reference is incorrect on page 94 (middle lower graphic).

Action: Editorial.

DMI Response: Fixed in new document.

18.2 NET LAND BASE REVIEW

The November 24, 2011 letter contained 17 points. Eight of the points are copied from the April 1, 2011 review and were addressed in the August 15/23, 2011 DMI submissions.

1) Align the age assignment in the yield stratification process with the age calculations in the landbase. Ensure the text and tables describe The AVI yield stratification process to allow its re-creation.

Action: Verify the text and table describing the AVI yield stratification process allow its re-creation.

Verify the adjusted AVI origins have been used in the growth and yield stratification process.

Item A) from April1, 2011 letter.

DMI Response: It is verified that the ages used in landbase and yield sections are consistent. The yield document has added documentation to address. The amended flat table contains all the required data items.

2) Confirm harvest area assignments are consistent with the Alberta Regeneration Information System (ARIS) validation procedures.

Action: Review April 12, 2011 email "Subject: DMI NET LANDBASE DOCUMENTATION REVIEW - Follow up - Harvest Area Assignment Expectations"

Included checklist/summaries to outline any inconsistencies with the Annex 1 Standard 3.11 and the ARIS Records Validation Procedures as required.

Item B) from April1, 2011 letter.

DMI Response: The status of the ARIS validation is presented in a separate document. Every reasonable attempt has been made to collect the required information. Checklists are provided.

3) Reference the origin update process (Adjustment of AVI Origin Year Values for 2011 DFMP Submission FMA0900044 and FMA0900045) in the land base document.

Action: Update the "Adjustment to AVI Origin Year Values for 2011 DFMP submission FMA0900044 and FMA0900045" to provide greater clarity around what stands were excluded from the process.

Item E) from April1, 2011 letter.

DMI Response: The August 15 / 23 submissions contained revised references to the the appendix containing the age update description. A new document that better explains which stands were excluded from the analysis is included in the August 23, 2011 submission and the newest submissions.

4) Add the required associated data field names and results to all landbase creation steps.

Action: Confirm all associated field names are referenced in the Query selection and outlined results.

Item F) from April1, 2011 letter.

DMI Response: This item was fully addressed in the August 15/23 submissions. ASRD review staff could not provide specific outages during this review.

5) Document changes caused by additional query steps in the text.

Action: Review all landbase creation steps and all associated field names and results (changes). Text, tables or figures are to provide sufficient detail to enable all queries be replicated.

Item G) from April1, 2011 letter.

DMI Response: This item was fully addressed in the August 15/23 submissions. ASRD review staff could not provide specific outages during this review.

6) Align flat file data dictionary field values with values found in the file.

Action: Per FMP Standard Annex 1 Section 1.2f, provide a description/definition for each valid code in Flat Table data dictionary.

Item H) from April1, 2011 letter.

DMI Response: This item was fully addressed in the August 15/23 submissions. ASRD review staff could not provide specific outages during this review.

7) Delete riparian buffers from the contributing / active land base.

Action: Ensure all associated field names are referenced in the Query selection and outlined results.

Delete remaining riparian buffers from the contributing/active landbase.

Ensure all query steps descriptions accurately reflect the access database query steps.

Item J) from April1, 2011 letter.

DMI Response: This item was fully addressed in the August 15/23 submissions. ASRD review staff could not provide specific outages during this review.

8) Confirm block regeneration codes align with values in the strata lookup table. See recommendation for item b) above.

Item N) from April1, 2011 letter.

DMI Response: This item was fully addressed in the August 15/23 submissions. ASRD review staff could not provide specific outages during this review.

9) Validation checklists

Action: Provide validated checklists for submitted components. Provide rationale to clearly outline areas where the standard is not achieved.

DMI Response: Done – all checklists provided by Robert Stokes upon specific request have been submitted.

10) Approved AVI - TPR and Origins included in final delivery.

Action: Confirm Annex 1 Standard 3.9.2 is met and all required attributes from the approved AVI, are included. Ensure the unadjusted origins and TPRs are included in the final Flat Table.

DMI Response: All required AVI attribute items are included in the submitted data tables. The clarification of adjusted versus un-adjusted origins is explained in the amended net land base documents. The amended flat tables contain the requested data items.

11) Require spatial inconsistencies, gaps and holes, in the dataset be removed.

Action: Confirm overlapping, and self intersecting polygons are corrected.

DMI Response: This item originally came up in 2010 when there were measureable errors in the shapefile creation steps. ESRI was unable to explain or fix the errors at that time. Immediately prior to the August 2011 submissions, ESRI provided a fix that seemed to eliminate most of the issue. There still remains some hidden flaw in shapefile creations that are beyond DMI to 100% eliminate. **DMI has not fully complied with this ASRD request – there are 7 errors present. They do not affect the TSA areas and thus have no bearing on the results of the modelling.**

Composite Forest Spatial Errors

After looking into the spatial integrity of the composite forest shapefiles, it was determined that there were 6 errors on the east-side FMA and 1 error on the west-side FMA. The following tables list the affected polygons and their associated areas in square metres.

East-Side FMA

cmpkey	**area (m^2)**
4047153	407.11561

4228671	370795.92088
4228675	168481.60161
4304402	3043.148053
4304405	40231.343316
4471002	0.000877

West-Side FMA

cmpkey	**area (m^2)**
3275179	0.148635

The ESRI ArcMap Fix Geometry tool was run to create new spatial shapefiles. The errors were fixed but the overall areas of the affected polygons do not change. The end result will be a shapefile for use in TSA with the same areas. It was deemed irrelevant and unnecessary to recreate all net land base and modeling steps (12 months work) in order to eliminate these miniscule irregularities.

12) Require documentation that other operators have been consulted.

Action: Provide documentation confirming operators were consulted and issues raised and addressed.

DMI Response: ASRD is an active member of the Plan Development Teams. Peace River ASRD staff will confirm that adequate consultation occurred. Each quota holder will provide a letter of support directly to Robert Stokes.

13) P1N AVI is greater than 10 years old.

Action: Document when / how Sustainable Resource Development (SRD) approved the use of old Forest Management Unit (FMU) P1 North AVI for this FMP.

DMI Response: This was discussed early in TOR discussions; however, DMI has no written documentation supporting use of this inventory. There is no other inventory available. P1N was added to the FMA after the opportune window for re-inventory passed. Thus DMI did not have responsibility for AVI collection during the years when the re-inventory would have been needed to meet this standard in 2009.

14) Landbase changes.

Action: Document the major differences between this landbase and the previous approved one.

DMI Response: Provided in Section 10 of the *Targets & Implementation* documents.

15) Detail Net Area Lost due to Seismic Line adjustments.
Action: Include a total row on "Area of Seismic Lines Removed from Net Landbase Table".

DMI Response: Done

16) Harvest area / disturbance ages.

Action: Ensure aging of harvest areas is consistent with past disturbances. Use the most current information (example: ARIS Reported Disturbance Dates, Clock Restart Date).

DMI Response: Cutover stratification used ARIS dates wherever present. The ARIS data is incomplete and suspect. Where ARIS aging was not possible, AVI calls were used.

17) Flat Table inclusion with deliverables.

Action: Provide a copy of the Flat File with landbase at completion.

DMI Response: Done.

Adjustment of AVI Origin Year Values for 2011 DFMP Submission (FMA0900044 and FMA0900045)

Prepared by:

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Daishowa-Marubeni International Ltd.
Peace River, AB

April 7, 2011

This document describes the methods used to resolve the disparity in overstory origin year values between the initial vegetation inventory (VI1) for FMA8900027 and the re-inventory (VI2) used for the 2011 DFMP submissions for FMA0900044 and FMA0900045. The report has three sections:

1. A description of the inconsistency between the two inventories, and its effect on forest growth models;

2. An explanation of the process used to resolve the discrepancy;

3. A summary of the results of the resolution process.

This report does not address possible causes of the disparity in origin year between VI1 and VI2; that question will be subject to further investigation. This report will focus on the efficacy of the solution that was applied.

1.0 Difference in origin year between VI1 and VI2

The original vegetation inventory for FMA 8900027 (VI1) was based on photography flown in 1989 and 1990, with the exception of FMUs F1 and P11, which were based on photography flown in 1996.

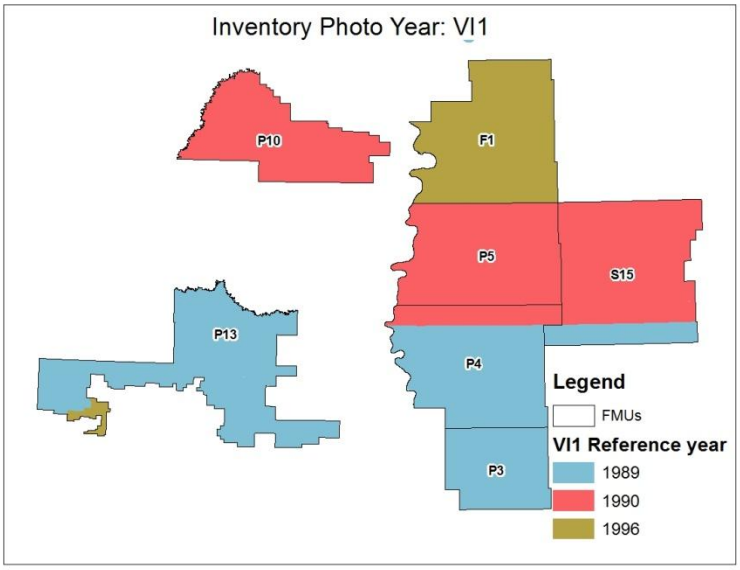


Fig 1: reference year for initial inventory (VI1)

The re-inventory (VI2) was based on photography flown 2003-2006 (Fig. 2). Note that VI2 also included FMU P1N, however this analysis considers only those FMUs that were subject to both inventories.

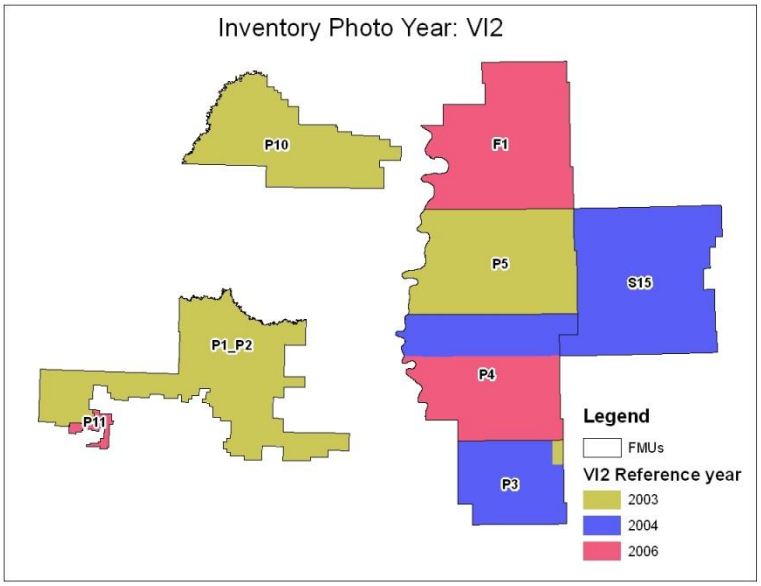


Fig 2: reference year for re- inventory (VI2)

All vector GIS layers required to replicate this analysis have been provided in a file-based geodatabase (*origin_adjust.gdb*).

A comparison between the two inventories showed that origin year had changed in the new inventory with a bias toward an increase in origin year (Fig. 3). To make this comparison, harvested areas (feature class *blocks*, n = 10,299) were erased from both VI1 and VI2 polygons, to isolate changes in origin year caused by differences in interpretation rather than by actual changes in forest condition. Both datasets were filtered by FMUs that were subject to both inventories (FMU in P1s, P2, P11, P3, P10, P4, P5, S15, F1), and only stands that had a valid overstory origin year in both inventories were considered, by applying the definition query *STAND_FOREST_COVER_CLASS IS NOT NULL*. The feature classes *VI1_nocuts* (n = 163,308) and *VI2_nocuts* (n = 151,942) are the result of these filters.

> (Note: *STAND_FOREST_COVER_CLASS* is a blended Broad Cover Group call of the *OSTORY* and *USTORY* values. Valid values are D, C, DC, CD)

VI1 polygons (*VI1_nocuts*) were then unioned with VI2 polygons (*VI2_nocuts*) to produce the feature class *FJA_nocuts* (n = 821,590). This feature class contains every combination of VI1 and VI2 polygons.

For each resulting polygon, the difference between VI1 origin and VI2 origin ([*VI1ORIGIN*] – [*VI2ORIGIN_INTERP*]) was calculated and written to the field *OLDDIFF*. The field *VI2ORIGIN_INTERP* is the original, unadjusted set of stand origin values received with the VI2 inventory.

Red areas are stands, or portions of stands, in which origin year had decreased from VI1 to VI2; blue areas are stands, or portions of stands, in which origin year had increased from VI1 to VI2, which was a much more common occurrence.

Note also that the change in origin year is minimal within FMU F1. This is because the VI2 within F1 was an update of VI1, with only minor changes made to the original inventory. Most (but not all) of the VI2 polygons within F1 are identical to the VI1 polygons, as are most (but not all) of the origin year values.

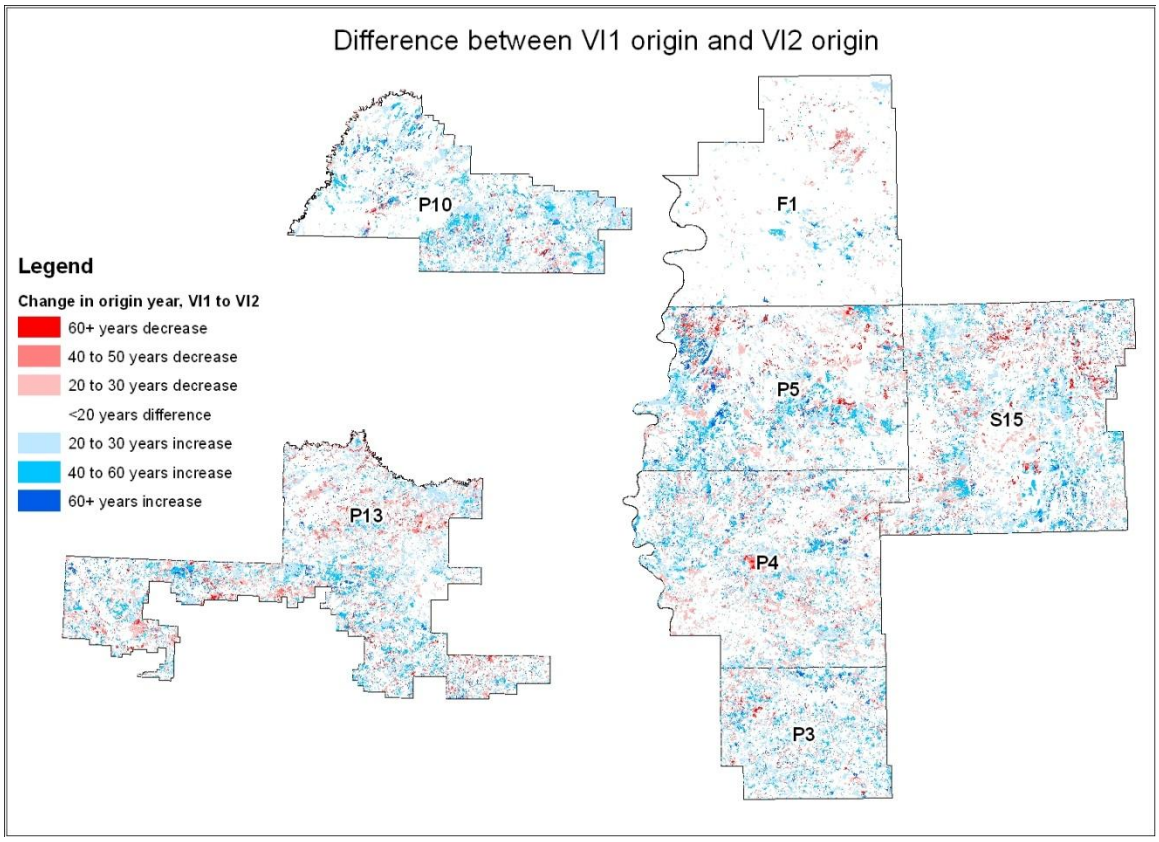


Fig 3: difference between VI1 and VI2 origin year

This change in origin year was manifested in an apparent increase in Timber Productivity Rating (TPR), since with predominantly younger stand ages, stands were assumed to have reached their measured height in a shorter time.

The TPR class for each stand was assigned a numeric value as follows:

U	Unproductive	1
F	Fair	2
M	Medium	3
G	Good	4

The numeric TPR class for each stand in VI1 was subtracted from the numeric TPR class in VI2 to determine how TPR changed in the re-inventory. Fig. 4 shows how the TPR, calculated from stand heights and ages, generally increased from VI1 to VI2. Red areas are stands, or portions of stands, whose TPR had improved (increased) in VI2, whereas

blue areas are stands, or portions of stands, whose TPR had decreased. This change in TPR led to unrealistic growth projections.

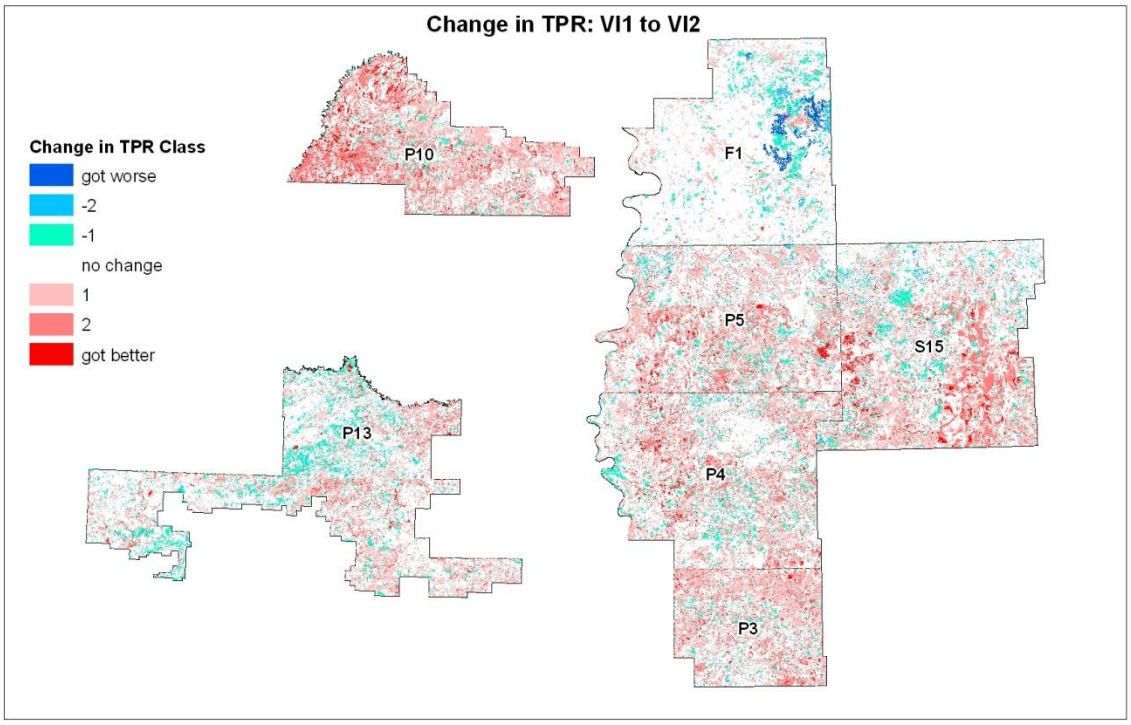


Fig 4: change in TPR class between VI1 and VI2

The total area of the unioned dataset was 2,353,217 ha. There were 404,511 ha (17.1% of unharvested, forested area), in which origin year had decreased from VI1 to VI2 (ie, stands became older), and 776,072 ha (33.0% of unharvested, forested area) in which origin year had increased (ie, stands became younger). Chart 1 shows the area distribution of changes in stand origin.

To measure the magnitude of the difference in origin year between the two inventories, the difference-weighted area (DWA) was calculated as the area of each stand (in ha), or portion of a stand, multiplied by the difference in origin year between VI1 and VI2. For example, a 1-ha stand whose origin year was 100 years different between VI1 and VI2 would contribute 10 times as much to the DWA as a 1-ha stand whose origin year differed by 10 years between VI1 and VI2.

The DWA in which origin year had decreased from VI1 to VI2 was 9,675,890 ha-years, whereas the DWA in which origin year had increased from VI1 toVI2 was 19,662,701 ha-years, or more than twice as much. This reflects the bias towards higher origin years in the new inventory. The total magnitude of the two DWAs was 29,338,591 ha-years.

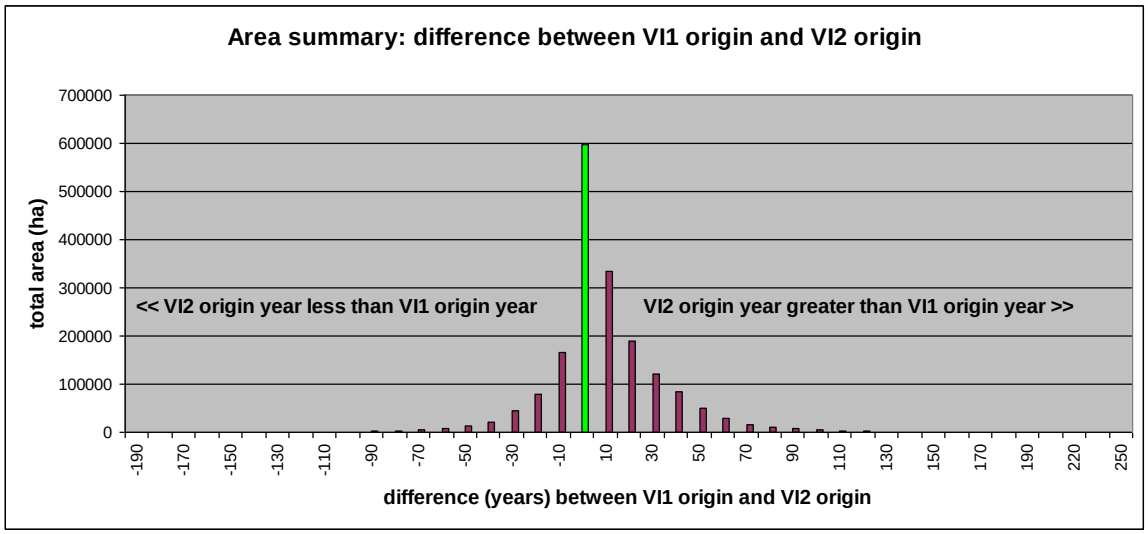


Chart 1: Area distribution by difference between VI1 and VI2 origin

2.0 Resolution of Origin Difference

At a meeting between DMI and ASRD in September 2010, it was agreed that an interim solution was to apply the VI1 origin years to VI2 stands, and to recalculate the yield curves based on the adjusted origin year values.

All vector GIS layers required to replicate this process have been provided in a file-based geodatabase (*origin_adjust.gdb*).

To determine the predominant VI1 origin year for each VI2 stand, a grid-based overlay was used. VI1 polygons were first filtered by FMU (FMU in (P1S, P11, P10, F1, P2, P3, P4, P5, S15)) to limit the analysis to areas common to both inventories. To eliminate the effect of harvest on stand ages, the feature class *blocks* was used to erase features from VI1 polygons, resulting in the feature class *VI1_nocuts* (n = 163,308). ArcGIS Spatial Analyst was used to convert these VI1 forest polygons to a raster (*vi1_origin*) with a cell size of 20m, using overstory origin year ([OSTORY_ORIGIN]) as pixel values (Fig. 5a). Only polygons with a valid overstory origin year ([STAND_FOREST_COVER_CLASS] is not null) were represented in the grid. At 25 pixels per ha, a horizontal resolution of 20m was considered sufficient to avoid introducing errors due to pixel size.

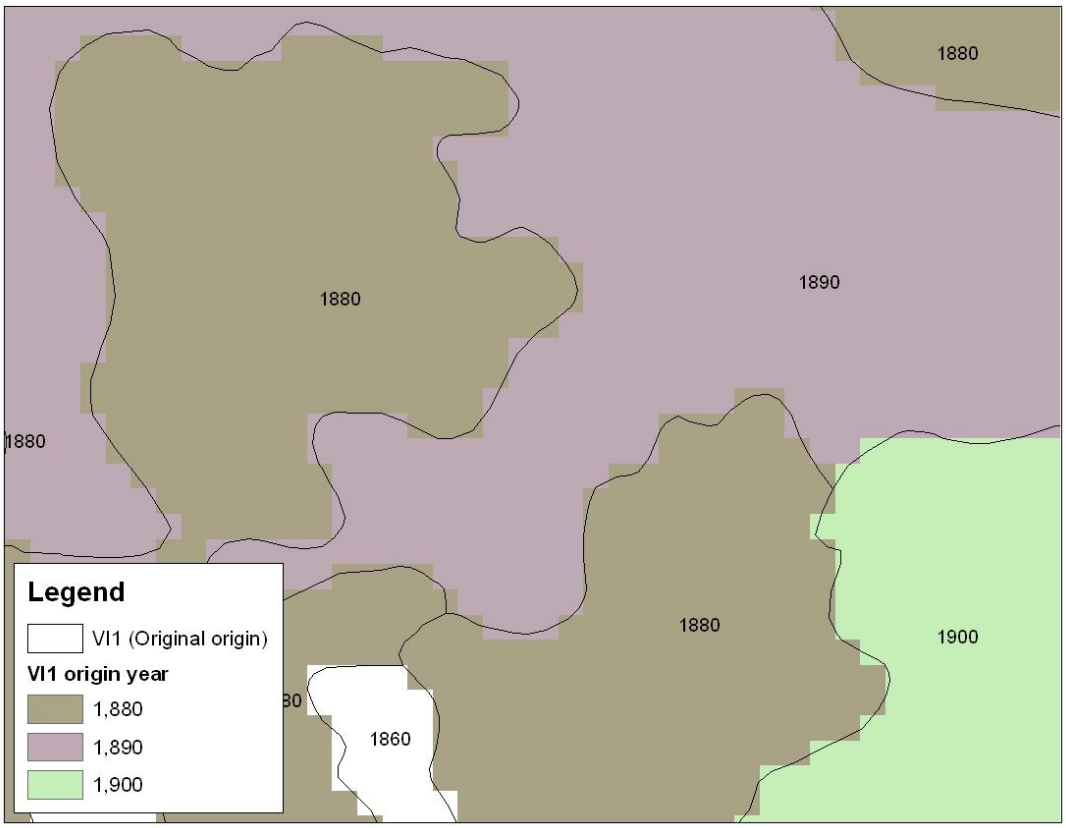


Fig 5a: VI1 converted to raster on Origin year

This grid was then overlaid with VI1 stands, also filtered by the definition query *FMU in ('F1', 'P10', 'P11', 'P1S', 'P2', 'P3', 'P4', 'P5', 'S15') AND STAND_FOREST_COVER_CLASS IS NOT NULL* (feature class *VI2_stands*, n = 151,942).

The Zonal Statistics process was run (using ArcView 3.2 Spatial Analyst extension) on the VI2 stands using the VI1 origin raster as the value raster (zone field = [STAND_ID]) (Fig. 5b). Using STAND_ID as the zone field ensured that each stand would only have a single origin value applied. This process generated summary statistics for each VI2 stand based on the underlying VI1 origin raster and exported them to a dbase table (*zstats*, n = 133,221). *VI2_stands* was joined with table *zstats* on field [STAND_ID]. There were 2959 records with Null values (ie, there were no underlying VI1 polygons), while 148,983 records had non-zero values.

Only VI2 stands in which more than half of the stand had an underlying VI1 origin were subject to adjustment. The area of each VI1 stand within a VI2 stand (field [zstats.AREA]) was calculated as the pixel count [COUNT] multiplied by 400; this is area (in m^2) of VI1 pixels assigned to each VI2 stand. The field [VI2_stands.P_VI1olap] was calculated as ([AREA]/10000)/ [STAND_AREA], where [STAND_AREA] has grouped all shapes by STANDID, and summed [Shape_area]/10000 to give the area of

the stand in ha. The binary field [update_] was calculated as 1 if [P_VI1_olap] was > 0.5; for all records where [update_] = 1, the integer field [VI1MAJ] was calculated as [zstats.MAJORITY].

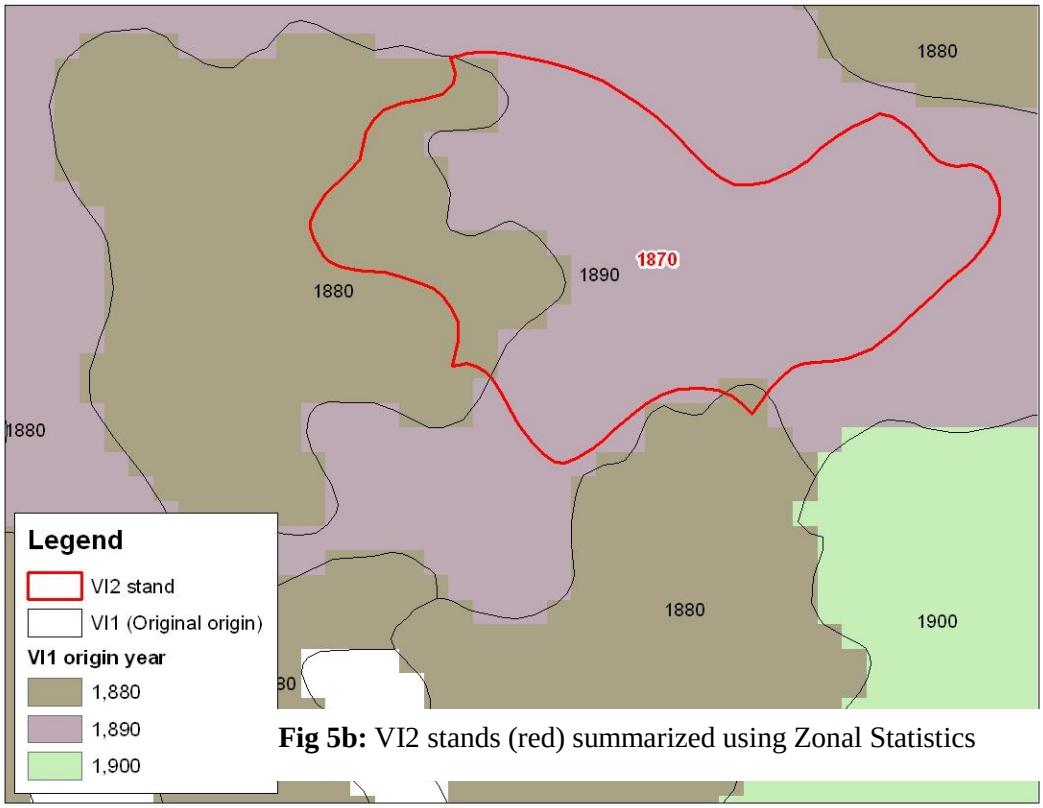


Fig 5b: VI2 stands (red) summarized using Zonal Statistics

The map below (Fig. 5c) shows how origin values for VI1 stands (black outline, labeled with origin year in black) were converted to grid (colored areas), and the most common value within each VI2 stand (red outline) was applied to the polygon (labeled in red, *VI2 origin >> Adjusted VI2 origin*). In this example, 1890 was the most common VI1 origin year occurring within the VI2 stand, so the value of 1890 was applied to this VI2 stand. This new origin year value is referred to as the *adjusted* origin.

Because the stand boundaries in VI2 do not correspond exactly with the stand boundaries in VI1, and VI2 stands were not split in this process, the application of VI1 majority origin values to VI2 stands caused some portions of VI2 stands to differ in adjusted origin from the underlying VI1 origin. This introduced discrepancy will be summarized in Section 3.

In this example, the red VI2 polygon has an area of 10 ha and an origin year of 1870; of this area, 8 ha has an origin year 20 years less than the VI1 origin, and 2 ha has an origin 10 years less than the VI1 origin. The DWA for this polygon would be (8 x 20) + (2 x 10), or 180 ha-years. After the origin year for the VI2 polygon was adjusted to 1890, 8 ha has an adjusted origin year identical to VI1 origin, but 2 ha now has an adjusted origin 10 years greater than the VI1 origin. The new DWA for this polygon would be (2 x 10), or 20 ha-years.

Note that VI2 origin values were adjusted in F1, to ensure consistency and avoid introducing a bias due to by differences in methods of determining stand origin between the two inventories.

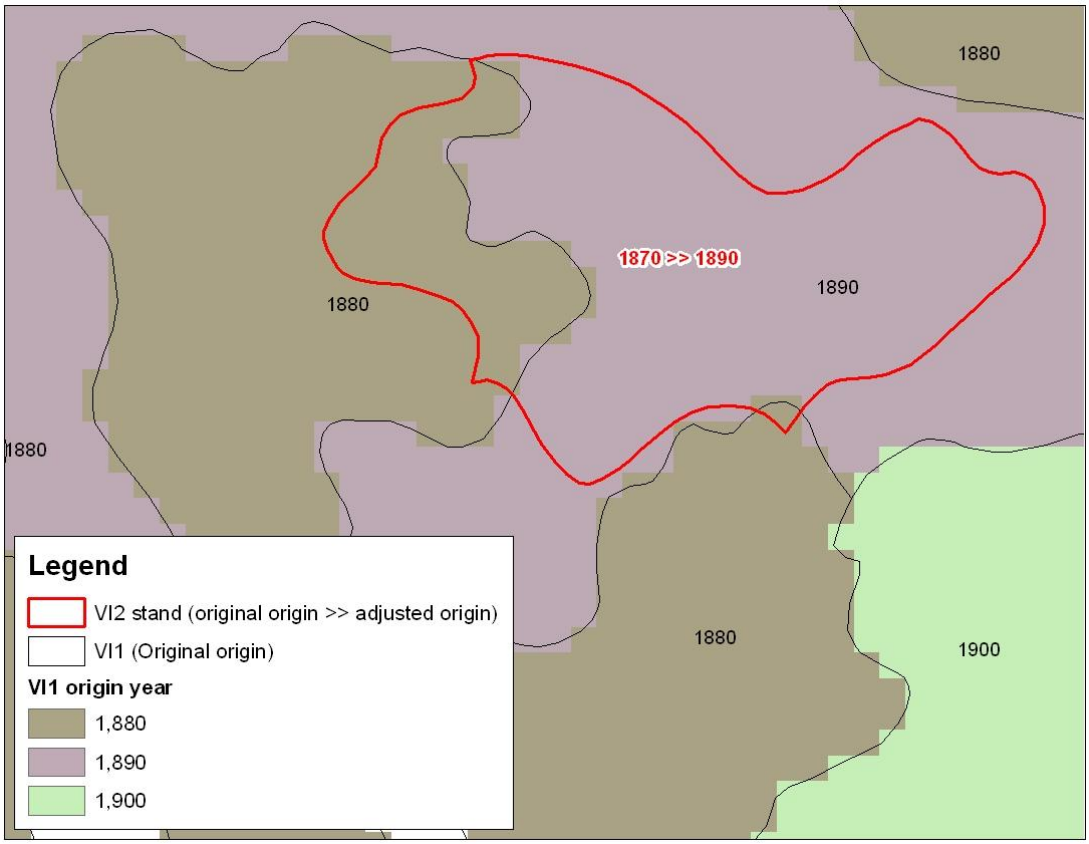


Fig 5c: Most common VI1 origin year applied to VI2 stand polygon

3.0 Area Summary: Adjusted VI2 origin

Using the adjusted VI2 origin year, there were 254,434 ha which origin year had decreased from VI1 to VI2 (10.8% of forested area), and 115,800 ha in which origin year had increased (4.9% of forested area) (Chart 2).
153,334 ha newdiff >0
129,560 ha newdiff <0

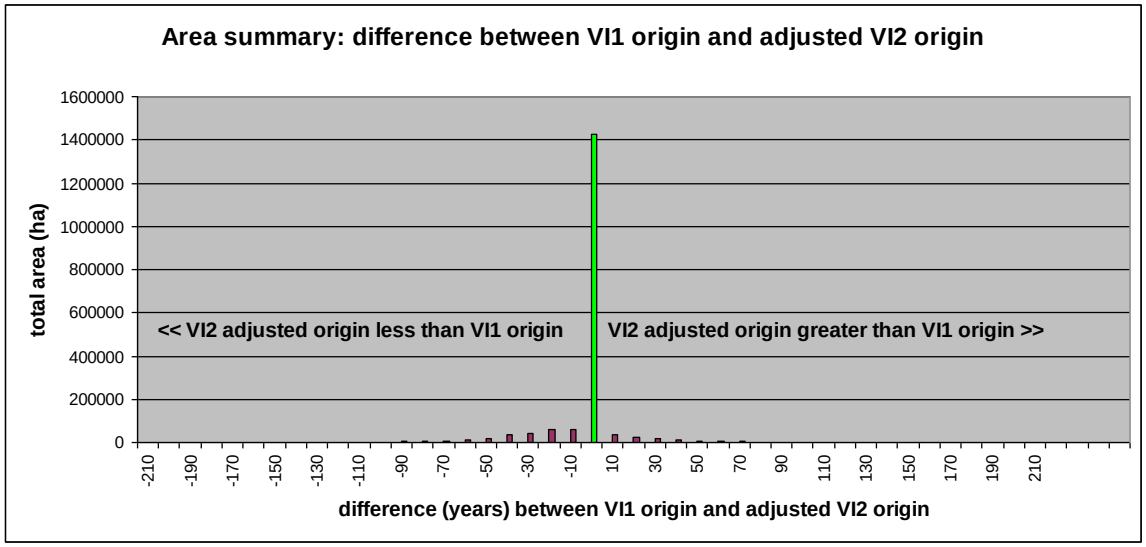


Chart 2: Area distribution by difference between VI1 and adjusted VI2 origin

Chart 3 shows the two area summaries together: the difference between VI1 origin and VI2 origin in red, and the difference between VI1 origin and VI2 adjusted origin in yellow.

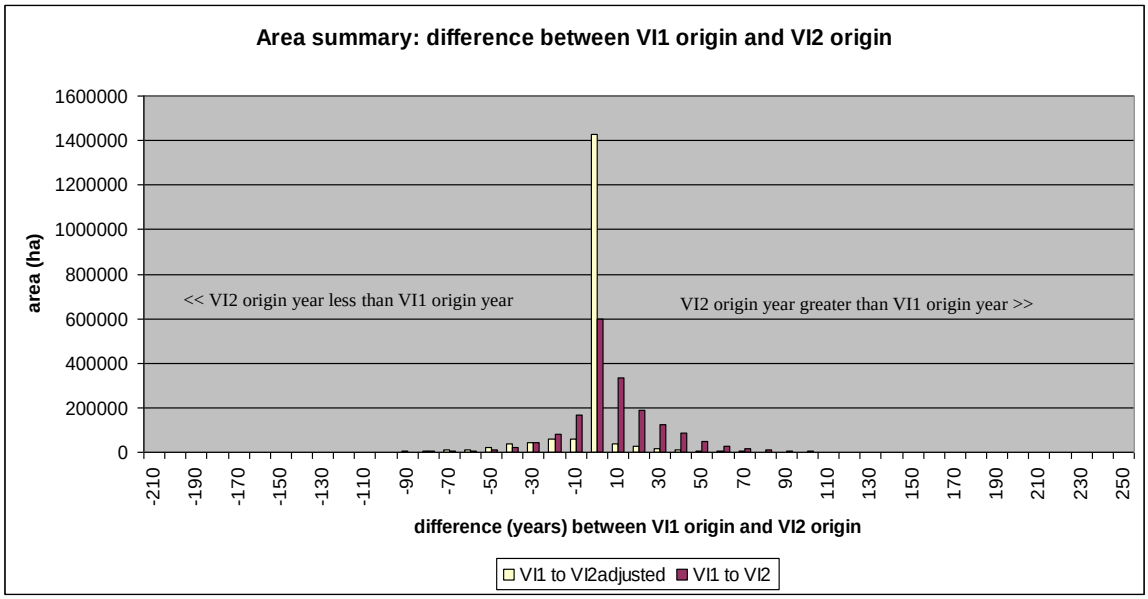


Chart 3: Area distribution by difference between VI1 and adjusted VI2 origin

The DWA in which origin year had decreased from VI1 to VI2adjusted was 8,142,815 ha-years, whereas the DWA in which origin year had increased from VI1 to VI2adjusted was 3,312,431 ha-years. The magnitude of the two DWAs was 11,455,245 ha-years, or 38% of what it was using the unadjusted VI2 origin (Chart 4).

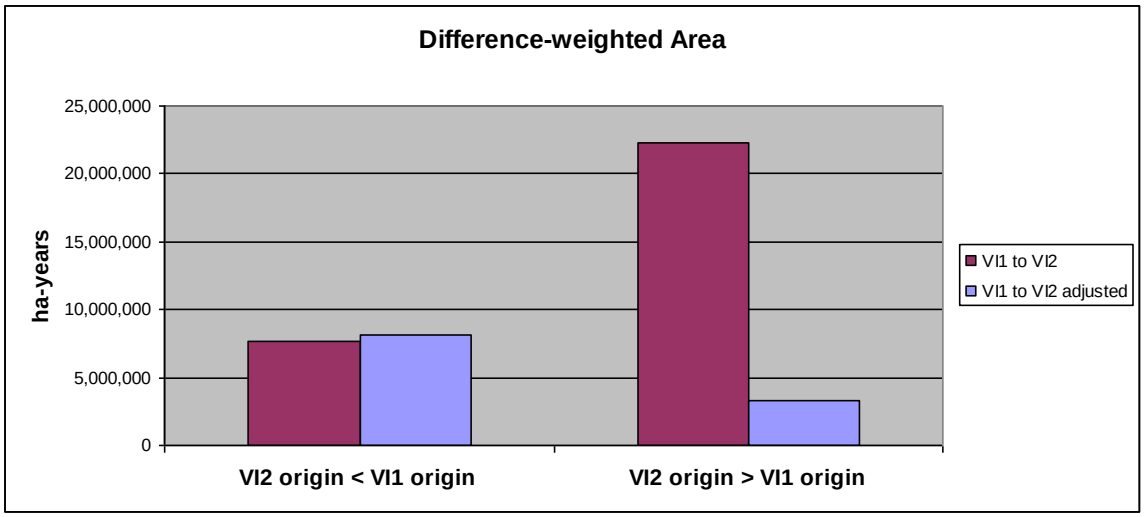


Chart 4: Area distribution by difference between VI1 and adjusted VI2 origin

TPR was recalculated based on adjusted VI2 ages and compared with TPR in VI1 (Fig. 6). The apparent increase in TPR shown in Fig. 4 was greatly reduced using the adjusted VI2 origin year values.

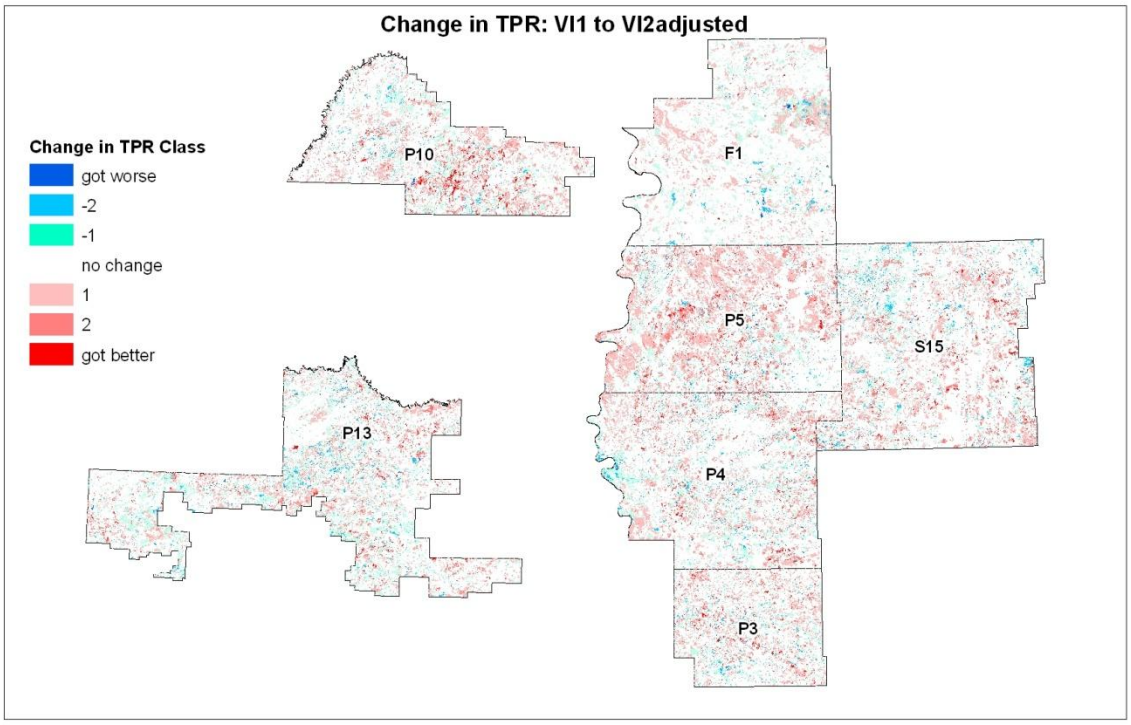


Fig 6: change in TPR class between VI1 and VI2

Conclusion

VI2 stand origin years were adjusted to reflect the most common VI1 origin year within each stand and this has significantly reduced the apparent change in stand origin from VI1 to VI2. For this DFMP submission, yield curves will be recalculated using the adjusted VI2 origin values pending a review of the methods used to determine VI2 stand origin.

Growth & Yield Information Package 2011

Detailed Forest Management Plan, 2009-2018

FMA 0900044
FMA 0900045

February, 2012

DAISHOWA-MARUBENI INTERNATIONAL LTD.
Peace River Pulp Division

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Growth & Yield Information Package 2011

Detailed Forest Management Plan, 2009-2018

FMA 0900044
FMA 0900045

AUGUST 31, 2011

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NOTE: This document is formatted for duplex printing. All empty pages are intentional.

Executive Summary

This information package describes methods and presents results of a merchantable utilization yield table system developed for the 2009-2018 Detailed Forest Management Plans of Daishowa-Marubeni International (DMI) Ltd., Peace River Pulp Division; located in west-central, Alberta.

The yield table system was based on the field sampling of an Alberta Vegetation Inventory (AVI) collected between 2005 and 2007.

Specifically, the yield table system described in this document includes:

1. Succession based stratification regime, referred to as 'Pathways';
2. Age-dependent yield curves;
3. cull-deduction estimates; and
4. Age-dependent piece-size estimates.

The age dependant yield curves will be used in strategic planning for DMI's upcoming 2009-2018 Detailed Forest Management Plans (DFMPs) for FMA 0900044 and FMA 0900045. The yield curves were based on a statistically defensible volume sample program conducted between 2005 and 2008. Development of these curves was guided by a framework described in a document submitted to Alberta Sustainable Resource Development (ASRD) on September 14th, 2006 and entitled, "2005 Monitoring and Growth & Yield Program". The framework was approved by ASRD on May 8th, 2007.

This submission is in response to ASRDs 'Yield Estimates' comments dated November 24, 2011. Each of the eight comments is copied verbatim below along with associated action taken and/or response made by DMI:

ASRD COMMENT	ACTION/RESPONSE
1) Interpreted Alberta Vegetation Inventory (AVI) attribute data and resulting stratum assignment are not provided linked to the plot data. Origin and age were absent from the plot data. Action: Resubmit data with interpreted AVI attributes, original origin and modified origin attached	AVI Origins linked to the plot data are now provided in the z3PLOTSTRAT table in the Access database under the headings: ORIGIN_NEW (one used in the GY model reported in this document) and ORIGIN_OLD (original origins used in first GY model).

ASRD COMMENT	ACTION/RESPONSE
2) Adjusted or modified AVI age is not documented in the "Growth and Yield Information Package 2011" (September 13, 2011). The stand origin field is referenced as AEP1991 but the data is not included. Action: Document how modified origins/ages were used. Maintain the original and modified origins in the data.	Action: Details will be provided in a separate document. Original and modified origins have been provided in the Access database.
3) Data references 2007/2010 Microsoft Access format (i.e. accdb), contrary to references made on page 7 and page 10 of the information package (i.e. mdb). Action: Editorial	Action: Fixed
4) Stratification description (page 21) is not consistent with SAS code. To align with stratification SAS coding (i.e. 04-019 STEP 5-STRATIFICATION v2.sas), step 8, section 3.1.1 Landbase Criteria should read: "8. Succession Grouped: Forest stand that did not have a significant proportion of pine black spruce or larch, OR that has a overstory broad cover group of "D" (i.e. [NF=0 and PXSBLT <=20% and uPXSBLT <= 40%] or [BCGo="D"]). Action: Editorial. Verify interpretation is correct and update document.	Response: Interpretation is correct. Action: Fixed wording.
5) Stratification description table 5 (page 22) for DU1, DU2 and DU3 are not consistent with the SAS coding (i.e. 04-019 STEP 5-STRATIFICATION v2.sas). The reference "...at least 'A' density conifer tree species in the understory..." should read "...any presence identified in the understory layer of shade tolerant conifers (i.e. Fb, Sw and Sb)...". Action: Editorial. Verify interpretation is correct and update document. Review stratification description to ensure description and the coding are correct.	Response: The 'A' density term is used to denote that at least 6% shade-tolerant understorey (AVI 2.1 specs.). The term "any presence" would indicate shade-tolerant understorey between 1-6% cover could occur and is not the case. Action: Changed the wording to read "at least 6%" instead of "A density" to avoided future confusion.
6) Reforestation Standard of Alberta 9RSA) Mean Annual Increment (MAI) targets are not included in the information package. Action: Include RSA MAI targets in the completed Forest Management Plan 9FMP). Contact/Lee Martins and Darren Aitkin to verity targets are properly defined prior to FMP completion.	Action: MAI targets will be determined and reported in a separate document.
7) There are a number of broken reference links and tabular formatting issues in the information package: for example on pages 22, 25, 26. Action: Editorial	Action: Fixed.
8) The graph or reference is incorrect on page 94 (middle lower graphic). Action: Editorial	Action: Fixed.

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1.0 INTRODUCTION

Merchantable growth & yield and piece-size tables were developed for Daishowa-Marubeni International Limited (DMI). The tables will be used in timber supply analyses to calculate Annual Allowable Cuts for DMI's 2009-2018 Detailed Forest Management Plans: one for FMA 0900044 (FMA East) and one for FMA 0900045 (FMA West). Figure 1 shows the location of the defined forest area for the two DFMPs to which this body of work applies.

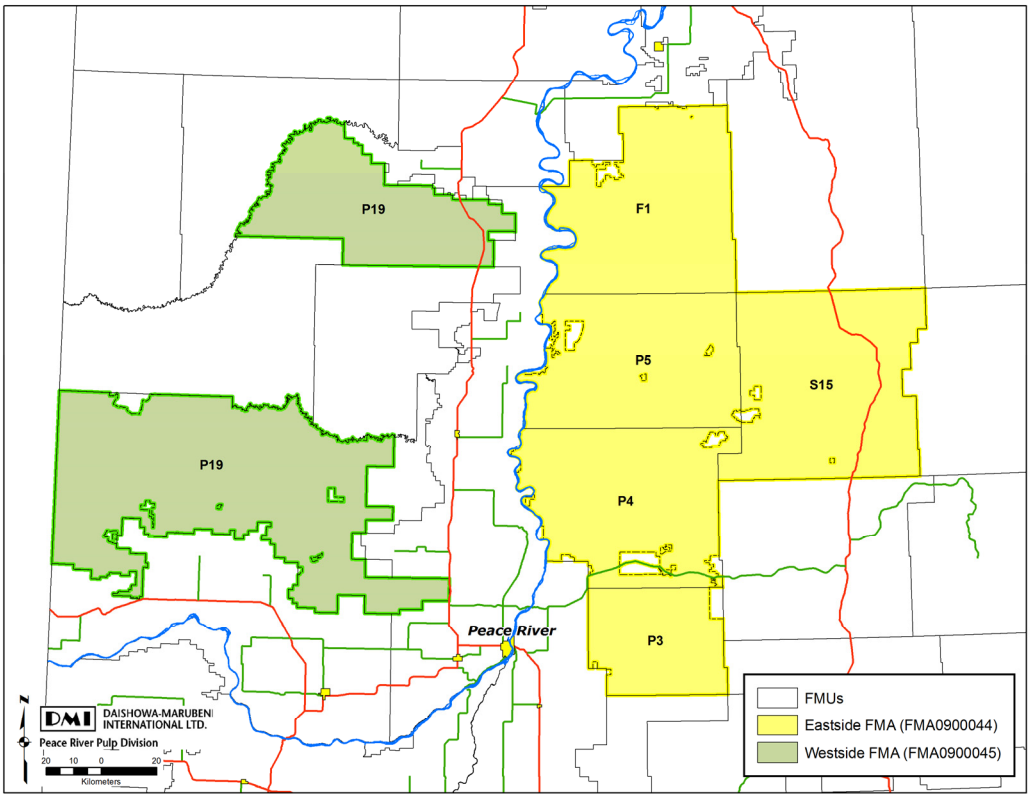


Figure 1. Location of DMI Forest Management Agreement Areas.

To provide a readily available reference, the final growth and yield and piece size tables, along with pertinent landbase stratification information, were summarized and compiled into a 'Fact-Sheet' format located in Section 9.0 of this document. Details regarding the development of these tables comprise the majority of this report.

1.1 BACKGROUND

In 2006, DMI and Alberta Sustainable Resource Development (ASRD) agreed to substantial revisions of DMI's earlier growth and yield program. Information regarding the new program were detailed in a document entitled, "2005 Monitoring and Growth & Yield Program", dated September 14th, 2006 and approved by ASRD on May 8th, 2007. A copy of this approval letter has been provided in Appendix-I. The purpose of the 2006 document, referred to hereafter as the "Framework Document", was to obtain ASRD approval prior to implementing actual work and to guide the preliminary work required for development of the growth and yield tables reported in this information package. More specifically, the document contained important information regarding the method that would be used for developing a Landbase-stratification (i.e. growth & yield strata or pathways) and a statistically defensible volume sample design, two important parameters that growth and yield table development depends.

The Framework Document also described DMI's intent for future forest monitoring. Details regarding monitoring were not written for this document as important components have yet to be determined. As well, certain methods required further thought prior to implementation as they were only outlined and not finalized. Therefore, a document describing the eventual monitoring plan will be forthcoming.

1.1.1 Earlier Growth & Yield Information Packages

2002

Growth and yield tables were developed for DMI's 2000-2009 DFMP and submitted to ASRD on October 30th, 2002. The tables were approved in early 2003.

The growth and yield tables presented in this information package were based on several methods (mainly regarding the stratification regime) used for the 2002 growth and yield tables and could be seen as an enhancement to these.

2009

DMI submitted its first growth and yield document, entitled "Growth and Yield Information Package 2008", to ASRD in April, 2009. ASRD Responded to this submission in August, 2009

(Letter attached in Appendix-II) together with DMI's separate submission of its Net Landbase and associated documentation. ASRD comments pertaining to the growth & yield documentation are recreated verbatim below in Table 1, along with the associated responses and actions taken by DMI. With the exception of the first comment, which required us to regionalize the yield curves to East & West FMAs, no major concerns were raised with the process used by DMI.

Table 1. Summary of ASRD comments, along with DMI's responses and actions from the first growth and yield submission to ASRD in 2009.

	(1) ASRD COMMENT	(2) RESPONSE OR ACTION
1	The sample design and yield estimates are intended for use in both the east and west FMA's. SRD is concerned that average yields that encompass both FMAs could represent and over-estimation on one side and an under-estimation on the other side. DMI needs to demonstrate that the yield estimates are applicable to both FMAs.	Yield curves have been regionalized to the East and West sides using the indicator variable modeling approach.
2	It is unclear how the final cull deduction was applied to the yield estimation model.	Cull deduction was applied to each individual tree after the individual tree volume was estimated and before the growth and yield modeling. This was stated in the Cull section and Growth & Yield modeling section of the initial submission document.
3	Area-weighted composite yield curves to the broad cover group should be provided.	These have been compiled and provided.
4	A table outlining the final net landbase areas by stratum should be provided.	This question is addressed in comment 6, below.
5	The model form used for piece size functions was not ideal. It resulted in extreme piece sizes for older age classes in some strata. DMI may want to impose an asymptotic minimum to ensure extreme piece sizes are avoided.	From the meeting with SRD (Sept 1st, 2009) it was revealed that the model form itself was not ideal for only deciduous piece-size in two pathways (Pathway 8 and 12) and not the entire population as indicated in the ASRD comment, above. Since deciduous was not the main yield modeled in Pathway 8 and a very minor component of yield in Pathway 12 and was it was decided that this would have no effect on the final AAC calculation.
6	The 'active landbase' number in the G&Y document (Tables 7 and 11) do not correspond with the 'net landbase' numbers in the net landbase determination document. Further explanation is required to explain where the 'active landbase' numbers came from.	Section 4.1.2 of the initial submission document stated that the final active landbase had not been determined at the time of submission and that this needed to be reconciled. However, this was not stated in the section pertaining to the pathway landbase distribution of the initial submission document and is no doubt the source of the confusion. A final, updated table has been provided in this report.

(1) ASRD COMMENT		(2) RESPONSE OR ACTION
7	The treatment of outliers in the yield estimation was questionable. Outliers were assumed to have a plot volume of zero, which is not common or generally accepted practice. Outliers are usually dropped based on well-defined criteria. Nevertheless, the results do not seem biased. DMI should use a more defensible approach in the future	In the initial submission document, plots did not fall under any category of an "*outlier"* but rather *"Plot-modification"* as the section heading indicated (See Section 6.3.2, "Plot Modification"). The usage of the term, which was used for two plots and occurred in the comments column in Table 29 where meant to imply "outlier qualities", in a descriptive usage of the term, and not meant to imply that some sort of statistically controlled filtering took place. We would have been prudent enough to provide details of an outlier analysis if we had done so. The use of the term has been removed to avoid further confusion.
8	A few yield curves had model forms that resulted in early culmination ages (e.g.: pathways 7 and 9). Alternative model forms could have been selected that would have produced yield estimates that culminated in a more typical age range. However, the yield projections are not unreasonably high and were shown to fit the data.	Based on the trend of the data, it is doubtful that any alternative model form would have produced yield estimates that culminated at significantly different age ranges. A possible explanation for the early culmination in Pathway 7 is that most dominated pine stands in DMI's operating area are located on more nutrient poor sites than say, on the eastern slopes of Alberta.
9	Stand and stock tables were provided in this submission. These are not considered a required element for FMP development, so they were not reviewed in detail. If DMI would like SRD to review and endorse these tables, a formal request should be submitted that describes their intended uses.	Stand and stock tables have been removed from this submission. DMI will request a review of these as a separate document in the future.

1.2 STRATIFICATION OVERVIEW

An important part of any growth and yield program is how the land-base is stratified. The stratification forms the fundamental component of growth & yield model development whereby the land-base is categorized according to logical, chronologically orientated, structural and process-based associations. Since growth & yield modeling deals with the prediction and forecasting (projection) of yield, pathways should also reflect, as close as possible, the elements that yield depend on. Therefore, realistic land-base stratification will greatly enhance the overall realism of the growth & yield model and hence, enhance our fundamental understanding of how the forest works and grows.

DMI views pathways as the central construct for forecasting and managing important forest management values on the land-base (Figure 2). Pathways are designed to predict a broad range of vegetation structure and related attributes, which enables multiple values to be predicted and therefore managed more easily. Thus, values such as down woody debris, lesser vegetation and wildlife habitat indicators may all be related to vegetation structure assemblages and modeled concurrently with yield in the pathway framework. In this way, scenario modeling can be conducted with more transparent and fluid results. For example and "hypothetically" speaking, if dogwood (*Cornus stolonifera*) is found to be a vital species for a faunal species of interest, DMI will be able to more effectively understand the overall impacts harvesting may have on this value and conversely, the impacts managing this value may have on harvesting, because the ecological value (i.e. dogwood) will be directly tied to the predictors driving harvest volume (i.e. pathways and stand age). Furthermore, since pathways will form future silviculture targets, through RSA development, DMI will be able to more effectively manage the abundance of a specific pathway on the land-base to ensure that any inherent value remains viable in the future.

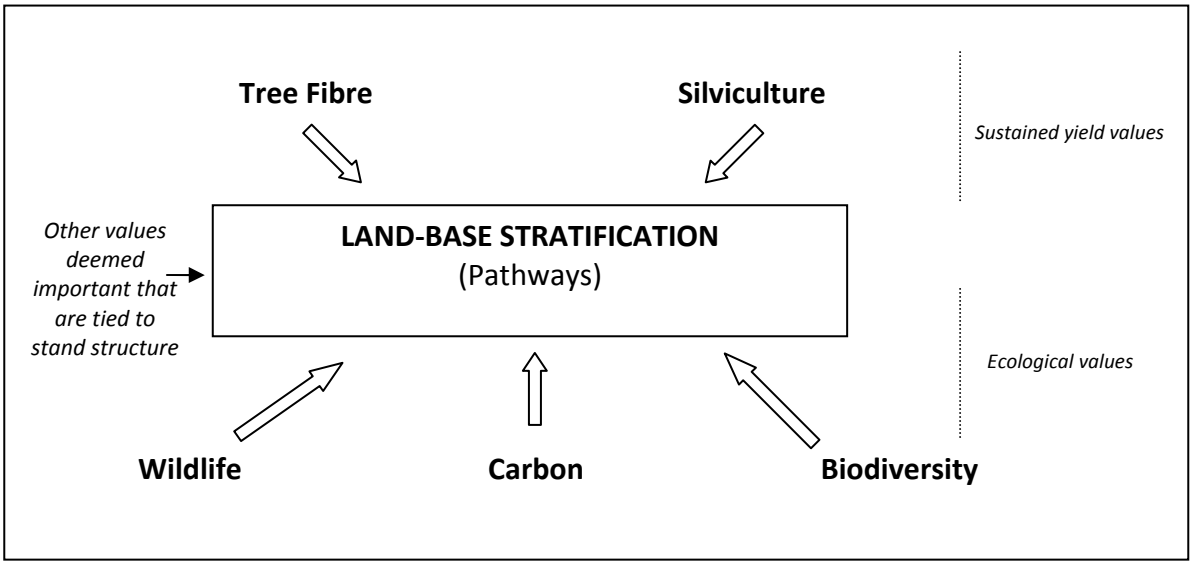


Figure 2. Land-Base Stratification Construct.
Representation of how the land-base stratification can form the central construct linking multiple forest management values and thus form a simple yet robust landscape level, cause-and-effect assessment system.

Succession

Several of DMI's pathways are succession based. Stand level succession is a fundamentally important process contributing to the state of forest structure. Not accounting for succession in the land-base stratification, particularly in mixed conifer-deciduous stands, leads to gross miscalculations of forest management values such as yield, wildlife habitat and biodiversity, for example. Specifically, assuming a vertically stratified mixed stand, where it is known that the overstory will eventually be replaced by a compositionally different understory, will have the same tree composition over long periods of time could lead to unrealistic volume projections. This will be more apparent in the future when sufficient years of PSP data become available to validate the yield of mixedwood pathways that have been assumed to remain compositionally static over time.

The most important benefit of having a succession model is that we can now more accurately forecast stand structure change and hence important values tied to stand structure. DMI has accounted for some of the structural dynamics on its land-base with a succession model for the aspen / white spruce relationship. Conceptually, the succession model is a landscape-level deterministic model customized for AVI data. Theoretically, the fundamental succession principles of 'replacement' and 'convergence' apply. That is, stands of varying compositional origins converge to similar stand types based on species characteristics (specifically shade response) and species composition of the overstory and understory at different points in time. For DMI's pathways, the older aged white spruce and white spruce / fir stands represent the final seral stand type (or coverstate) of all the mixedwood pathways. How the succession model is applied is described in more detail in Section 3.0 of this document.

1.3 FILES FOUND ON ATTACHED DVD

For the purpose of providing ASRD with a tangible assessment of the methods and results described in this information package all digital files used for this program have been copied to a DVD and affixed to this document. The digital files include:

1.3.1 Databases

1COMPILED RAW FIRE ORIGIN DATA1.accdb -Microsoft Access Database containing all the raw 2005 VSP data compiled into one database. The database does not include the FMU F1-Sample data collected in 1999.

2DMI 2005 DFMP PLOT DATA CLEANED.accdb -Microsoft Access Database containing cleaned compiled volume sample data. This database includes the F1-sample data collected in 1999.

3CULL STUDY DATABASE.accdb -Microsoft Access Database containing cleaned compiled cull data. Volume Data Compilation Programs:

1.3.2 Volume Data Compilation Programs

04-019 STEP 1a -CLEAN COMPILE RAW aHEADER data.sas -SAS program that compiles and cleans the Header table information from the TSP-2005 and PSP data.

04-019 STEP 2 -CLEAN COMPILE RAW bTREETALLY data.sas -SAS program that compiles and cleans the Tree Tally table information from the TSP-2005 and PSP data.

04-019 STEP 3 -TREE VOLUME COMP.sas -SAS program that estimates the merchantable volume for each individual tree.

1.3.3 Cull Compilation Programs

3Compile raw cull data.sas -SAS program that calculates the cull volume from area

4Create Cull Table.sas -SAS program that creates the Cull deduction table

1.3.4 Age Dependent Yield Curve Programs

04-019 STEP 5 -STRATIFICATION v2.sas -SAS program that assigns the succession and static based stratification to AVI data. (Note that step 4 was an older inventory compilation program that was longer required once the entire FMA inventory was completed).

09-025_ STEP 6 -GY MODELINGwF1_FMA_SPLIT.sas -SAS program used to develop the yield tables.

04-019 STEP 7 -PS MODELING_Path1.sas -SAS program used to develop the piece size tables.

1.3.5 Reporting

04-019 DMI 2005 Monitoring and Growth and Yield Program Sept-14-2006 v2.pdf - Approved Framework.

PSP Sampling Manual_V8.pdf -PSP Sampling Manual.

TSP Sampling Manual_V8.pdf -TSP Sampling Manual.

04-019 DMI Cull Estimation Plan Draft v2 06-Aug-2007.pdf -Cull Estimation Plan approved by SRD.

DMI_GY_INFORMATION_PACKAGE_2012.pdf -pdf version of this information package. Note that this document has been formatted for duplex-printing; therefore, most blank pages that occurred were intentional.

2.0 RAW DATA SOURCES

This section describes the information sources used for the stratification, growth and yield modeling and piece size modeling, as well as the cull deduction development. In summary, three main data sources were used:

1. Alberta Vegetation Inventory (AVI) data
2. Tree Volume data
3. Cull data

Each data source is described in more detail in the following subsections.

2.1 ALBERTA VEGETATION INVENTORY (AVI) DATA

A new forest inventory for DMI's FMA areas (FMA 0900044 & FMA 0900045) was collected in phases by FMU, to Alberta Vegetation Inventory (AVI) 2.1 standard during the years 2003, 2004, and 2006. This new inventory replaced the original AVI inventory collected between 1989 and 1991.

The FMU formerly known as P1N was inventoried in 1997 to an AVI 2.1 standard and was not re-inventoried with the rest of the former FMU now comprises the two FMAs. This AVI is referred to hereafter as the '2005-AVI'.

AVI is the central and single most important information source used for making operational and strategic forest management decisions in Alberta. AVI could be seen as a 'snap-shot' reality of the forest-structure through human interpretation of remotely sensed aerial-photography and constrained by a set of rules, or standards. For growth and yield, this snap-shot reality of forest structure, specifically yield, is what is sampled, modeled and forecasted in the future.

Table 2 provides the submission and ASRD approval date by each FMU in DMI's FMA. Except for FMU F1, all FMU's were resurveyed independent of the original AVI line-work in a 'hardcopy' environment. The inventory for FMU F1 was resurveyed dependent of the original

line work using the 'retro-fit' method in a softcopy environment. Although new field calibration plots were established according to the current AVI 2.1 specifications, the field calibration data collected from the 1999 inventory was also used for calibration of the 2009 inventory.

Table 2. Summary of AVI completion and approval date, by FMU for DMI's FMA areas.

(1) FMU	(2) DATE COMPLETION	(3) DATE APPROVED
P1-North	Sep 16, 2004	Aug 22, 2005
P1-South (P13)	Nov 25, 2004	Aug 22, 2005
P11	May 18, 2007	Jun 12,2009
P2 (P13)	Mar 22, 2005	Aug 22, 2005
P10	Jul 10, 2005	Oct 3, 2005
P3	Apr 18, 2006	Dec 11, 2007
P4	Oct 2, 2007	July 21, 2008
P5	Oct 2, 2007	May 8, 2008
S15	Oct 2, 2007	Dec 11,2009
F1	Mar 25, 2008	Pending

2.2 TREE VOLUME DATA

The tree volume data is digitally loaded to the CD attached to this information package. It is stored in a Microsoft Access (2007) database (referred to hereafter as the "tree volume database") and contains the legal and tree mensuration data required to develop growth & yield models. Figure 3 summarizes the structure of the tree volume database. The main field data are stored in two tables. Compiled data required for growth and yield are stored in four additional tables. Although fewer tables could have been used (based on similar relational associations) it is felt that additional tables should be created so that calculated data is clearly defined from data collected in the field. **Note** that there is one more record in the z3PLOTSTRAT table than in the z2PLOTVOL table because one plot (4025-1) has two different deletions (LRG_PERM: large permanent stream buffer; STEEP: steep slope) across the

subplots. This does not affect growth and yield however since both plots are deletions and removed from the modelling.

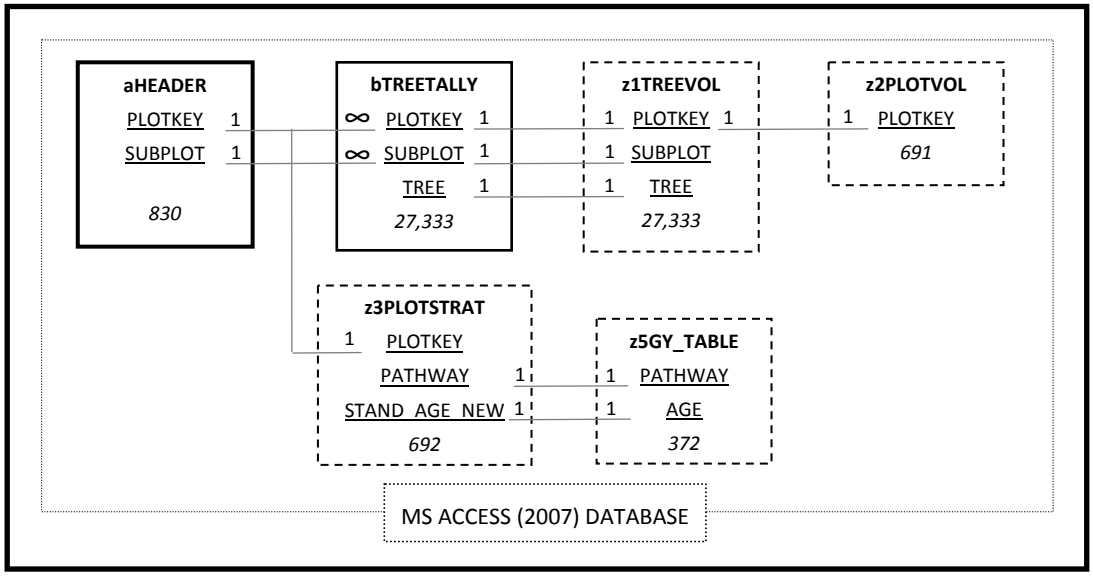


Figure 3. Structure of database stored on attached CD.

This database represents the "2DMI 2005 DFMP PLOT DATA CLEANED.accdb" described in Section 1.3 above. Tables with solid borders store data collected primarily in the field (Note that some values in the bTREETALLY table are calculated if missing). Tables with dashed borders store calculated data. Numbers in italics at the bottom of each box are the number of records in the respective table. One-to-one table relationships are depicted using the symbol "1 1". One-to-many table relationships are depicted using "1 ∞".

Data from three different sampling programs are stored in the database:

- **TSP-1999** -temporary sample plots established in FMU F1 in 1999;
- **TSP-2005** -established in DMI's FMA between 2006 and 2008;
- **PSP-2005** -established in DMI's FMA in 2006 and 2007.

Plots from all three sampling programs were established in natural ("fire") origin stands. Plots from the TSP-1999 program were established using a cluster design of three 100 m^2 circular subplots. Plots in the TSP-2005 program were established using a single plot design of one 400 m^2 circular plot or one 200 m^2 plot. All plots in the PSP-2005 program were established using a single plot design of one 400 m^2 circular plot. Sampling manuals for both

the PSP-2005 program and TSP-2005 program are provided in Appendix-3 and Appendix-4, respectively.

To account for the cluster design of the TSP-1999 program, the data is represented in a subplot format with letters 'A', 'B' and 'C' designated for the subplots. For both the TSP-2005 and PSP-2005 programs only the letter 'A' is used since these programs are not based on a cluster design. For growth and yield and piece size analysis all subplots were summarized to their respective Plot aggregates before running the regression models; i.e. modeling was conducted on the plot level and not the subplot level.

Not all plots from the TSP-1999 program had three subplots. The F1 TSP-1999 program was established under a Phase-III inventory. When the locations of these plots were transferred to the new AVI inventory some subplots moved to other stands: defined spatially by polygon boundaries. These subplots were assigned plot numbers distinct from the original cluster. This was not an issue from the 1999-AVI to the 2005-AVI since FMU F1 retained most of its original line work during the update.

Much of the Information collected in the TSP-2005 and PSP-2005 sampling programs were not collected in the TSP-1999 program. Also, certain information was collected in the PSP-2005 program but not the TSP-2005 program. Consequently, certain variables (fields) collected for the aHEADER table are populated with 'null' values for the TSP-1999 and TSP-2005 programs after the threes datasets were merged.

2.2.1 Total Subplots and Plots

A total of 830 *subplots* are stored in the database. The database includes a total of 228 subplots established under the TSP-1999 program, 456 established under the TSP-2005 program and 146 established under the PSP-2005 program. The subplots from the TSP-2005 and PSP-2005 programs are also viewed as plots, since these programs did not use the cluster sampling design of the TSP-1999 program.

The total number of *plots* stored in the database is 691. This includes 89 plots established under the TSP-1999 program (when the subplots were 'rolled up' to plot level designates),

456 plots established under the TSP-2005 program and 146 plots established under the PSP-2005 program.

No subplots or plots from DMI's 1999 Volume Sample Plot (VSP) or Industrial Sample Plot (ISP) programs are in the database since this data was not used to develop the models (See Section 4.0).

2.2.2 Table Summary

A summary for each table in the database was developed and added to the database; labelled 1 TABLE DICTIONARY. A data dictionary for each table was also developed and added to the database; labelled '2 DATA DICTIONARY'. Data dictionaries having more detail regarding the sampling protocols, for both the aHEADER table and bTREETALLY table, can also be found in the PSP and TSP sampling manuals (Loaded on the Accompanied CD), respectively. A brief summary for each table is provided in the following subheadings.

aHEADER

All values in this table were collected in the field except for important legal location and certain plot coordinates provided prior to establishment of the plot. The table also contains certain plot design and site information such as plot-size, field crew initials and plot-level AVI call for example.

The plot numbering scheme reveals the sampling program. All plots from the TSP-1999 sample program have plot numbers in the '4000' series (i.e., 4001, 4002…4076). All plots from the TSP-2005 program have plots in the '5000' series. Finally, all plots from the PSP-2005 program have plots in the '6000' series.

The Unique-ID field is the PLOTKEY field, which is a concatenation of Plot-Number and Measurement Number. All plots stored in the database have the measurement number '1' since none have been re-measured to date. The table also contains an additional unique field (SUBPLOT) to account for the three-plot cluster design used in the 1999 F1 sampling program; values are either 'A', 'B' or 'C'. For plots established under the TSP-2005 and PSP-2005 programs, which do not have a cluster design, the subplot values are always 'A'.

bTREETALLY

All values in this table were collected in the field. The table stores the tree mensuration data tallied in each plot. Only trees greater than or equal to 9.1 cm Diameter at Breast Height (DBH) were collected. Like the aHEADER table above, this table also has an additional subplot field and joins to the aHEADER table through the unique PLOTKEY and SUBPLOT field.

z1TREEVOL

This table stores calculated individual tree volume data computed using a SAS program loaded onto the CD attached to this information package.

Like the aHEADER and bTREETALLY table above, this table also has an additional subplot field to account for the cluster design of the 1999 F1 sampling program.

Although the calculated individual tree volumes could have been appended directly to the bTREETALLY table (since they have a one-to-one table relationship) the table was kept separate in order to clearly define sample values from calculated values.

z2PLOTVOL

This table stores calculated plot-level volume data compiled to the plot level from the z1TREEVOL table above. Specifically, the table contains plot-level cubic meters, cubic meters per hectare and stems per hectare values.

This table does not have the additional subplot field since volumes are compiled to their respective plot level aggregates. This affects only subplot clusters established under the 1999 F1 sampling program since this was the only program of the three programs to use the three-plot cluster design.

z3PLOTSTRAT

This table stored the stratification (i.e. pathways) of AVI data for just those stands having a volume sampling plot located within respective polygon boundaries. The new and old stand-ages and origins are stored in this table.

z4GY_TABLE

This table stores the final growth and yield table calculated using the previous tables.

2.3 CULL DATA

Cull data was digitally loaded to the CD attached to this information package. It is stored in a Microsoft Access (2003) database (referred to here-after as the "cull database") and contains the legal and cull data required to develop cull deduction tables. The database structure is provided in Figure 4. Five tables are used to store the data. Like the tree volume database, fewer can be used to store the data but it is felt that additional tables should be used so that calculated data is clearly defined from data collected in the field.

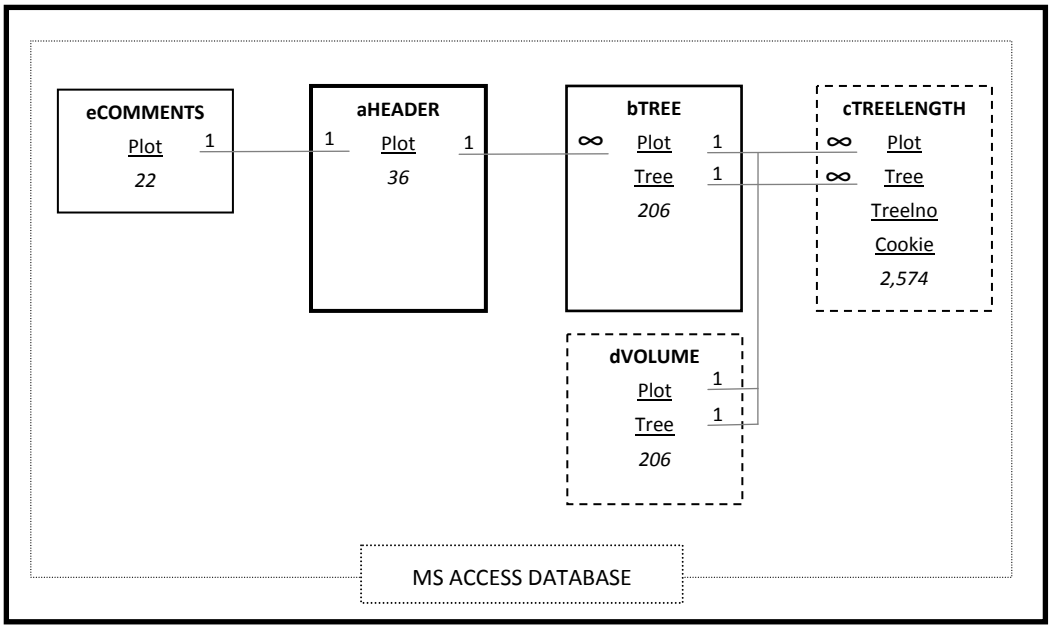


Figure 4. Database structure of stored cull data.

This database represents the "3CULL STUDY DATABASE.accdb" Tables with solid borders stored data collected in the field. Tables with dashed borders stored calculated data. Numbers in italics represented the number of records in the respective table.

A total of 2,574 tree sections, collected from 206 trees in 36 plots, are stored in the database. No data from other sampling programs are stored in the database.

A data dictionary for each table was developed and added to the database; labelled '2 DATA DICTIONARY'. A brief summary for each table is provided in the following subheadings.

aHEADER

All values in this table were collected in the field. The table contains legal and site description information. The plot number is the Unique-ID field. The numbering convention differentiates between two phases of the sampling program. Plot numbers that have at least three-digits and starting with the number '4' represent plots established after changes to the sampling protocols were made (See Section 5.2 for details). Plot numbers are also not in sequence (i.e. missing plot numbers) due to certain plots initially allocated in a GIS but not established in the field.

bTREE

All values in this table are collected in the field. The table stores mensuration data for each destructively sampled tree. This table joins to the aHEADER table using the plot number field.

cTREELENGTH

Values were collected in the lab or calculated using SAS programs. This table stores the insipient decay and advanced decay area (cm^2) and volume (cm^3) of the tree section (inside bark) for each tree length. Four fields make up the unique ID for this table: [Plot], [Tree], [Treelno] and [cookie]. This table joins to the bTREE table through the plot and tree fields.

dVOLUME

Values were calculated using a SAS program based on the information stored in the cTREELENGTH table. Here the total inside bark volume, insipient decay volume and advanced decay volume were calculated for each tree.

eCOMMENTS

Values were collected in the field. Stores additional pertinent information not captured by the plot forms.

3.0 LANDBASE STRATIFICATION

The pathways that will form the stratification to model deciduous and coniferous yield and piece size are listed in Table 3. The distribution of pathways across the active, inactive and total landbase area (hectares) is provided in Table 4. Pathway 0 represents non-forested stands. Pathway 13 represents forested stands that will be part of the inactive landbase (i.e. 'netted out') and not modeled for yield. Pathways 1 to 6 and Pathway 11 are succession based pathways: a collection of stands where the stratification includes stand-age (i.e. is age-dependent). The labelling of the succession based pathways is overstory specific. For example, "Aspen>>Late Mixed>>White Spruce" (Pathway 3) can be interpreted as: "overstory begins as aspen dominated, succeeds late to a mixedwood then finally to a white spruce state". The remaining pathways (7-10, 12-13) are static based pathway; that is, the structure criteria is not age dependent and thus, remains constant over time.

Table 3. List of pathways and associated descriptions that defined the landbase stratification.

AVI tree species abbreviations were used in the description. *Aw*-Aspen; *Bw*-White birch; *Pb*-Balsam poplar; *Pl*-Lodgepole pine; *Pj*-Jack pine; *Lt*-Larch; *Sb*-Black spruce; *Sw*-White spruce; *Fb*-Balsam fir. Model Types are: *N.F.* -Non Forested; *SUCC*-Succession based pathways; *STAT*- Static based pathways

(1) PATH-WAY	(2) PATHWAY LABEL	(3) MODEL TYPE	(4) GENERAL DESCRIPTION
0	Non Forested	N.F.	No Trees in the overstory or understory
1	Aspen >> Shrub	SUCC.	Aw dominated stands that succeed to open Aw and/or closed shrub stands
2	Aspen >> White spruce	SUCC.	Aw dominated stands that succeed late to open Sw stands with no overstory mixedwood phase in between.
3	Aspen >> Late Mixedwood >> White spruce	SUCC.	Aw dominated stands that succeed to Sw dominated stands with a late and well defined overstory mixedwood phase in between.
4	Aspen >> Early Mixedwood >> White spruce	SUCC.	Aw dominated stands that succeed to Sw dominated stands with an early and well defined overstory mixedwood phase in between.
5	Mixedwood >> White spruce	SUCC.	Aw leading mixedwood stands that succeed early to Sw dominated stands.
6	White spruce >> White spruce	SUCC.	Sw leading or Sw dominated stands that succeed to or remain Sw dominated stands over time. This stand type represents the eventual convergent pathway for Pathways 3, 4 and 5.
7	Pine	STAT.	At least 80% Pl composition in the stand.
8	Pine-Black spruce-Deciduous	STAT.	Pl or Sb leading with at least 20% deciduous component.
9	Deciduous-Pine-Black spruce	STAT.	Deciduous leading with at least 20% Pl and/or Sb component.
10	Pine-White spruce	STAT.	At least 20% Pl with at least 20% Sw
11	Balsam Poplar >>Shrub	SUCC.	Pb dominated stand that succeeds to an open Pb and/or closed shrub stand
12	Black spruce-Pine-White spruce	STAT.	At least 20% Sb with at least 20% Pl or at least 20% Sb with at least 20% Sw
13	Black spruce	STAT.	At least 80% Sb + Lt component

Table 4. Areas (in hectares) for each pathway by East-side, West-side, active landbase, inactive landbase and total landbase.

(1) PATHWAY		(2) EAST FMA			(3) WEST FMA			(4) COMBINED FMA		
No.	Label	Active	Inactive	Total	Active	Inactive	Total	Active	Inactive	Total
0	Non Forested	0	275,521	275,521	0	77,814	77,814	0	353,334	353,334
1	Aspen >> Shrub	318,278	47,653	365,932	134,501	27,881	162,381	452,779	75,534	528,313
2	Aspen >> White spruce	116,168	5,500	121,667	60,151	3,361	63,511	176,318	8,860	185,179
3	Aspen >> Late Mixedwood >> White spruce	87,908	5,548	93,456	31,246	1,971	33,217	119,154	7,519	126,673
4	Aspen >> Early Mixedwood >> White spruce	62,232	5,332	67,564	36,634	2,689	39,324	98,867	8,021	106,888
5	Mixedwood >> White spruce	44,035	7,226	51,261	26,446	4,178	30,624	70,481	11,404	81,885
6	White spruce >> White spruce	89,511	15,029	104,540	61,337	12,917	74,254	150,848	27,946	178,794
7	Pine	37,361	3,541	40,902	79,680	2,553	82,234	117,042	6,095	123,136
8	Pine-Black spruce-Deciduous	16,860	3,636	20,495	28,828	1,887	30,715	45,688	5,523	51,210
9	Deciduous-Pine-Black spruce	14,487	2,972	17,459	17,402	2,335	19,737	31,889	5,307	37,196
10	Pine-White spruce	11,601	573	12,174	22,858	1,347	24,205	34,459	1,920	36,379
11	Balsam Poplar >>Shrub	21,253	17,750	39,003	10,203	4,248	14,452	31,456	21,999	53,455
12	Black spruce-Pine-White spruce	49,719	9,507	59,225	88,641	5,338	93,979	138,359	14,845	153,204
13	Black spruce	0	422,723	422,723	0	200,218	200,218	0	622,942	622,942
	TOTAL	*869,413*	*822,510*	*1,691,924*	*597,927*	*348,738*	*946,665*	*1,467,341*	*1,171,248*	*2,638,589*
	Land in the net landbase data file that is not part of the FMA			43,667			12,887			56,554
	Gross Landbase Area			1,735,591			959,552			2,695,142

3.1 STRATIFICATION METHODS

Four distinct stand-structure criteria and one decision based criteria are used in the stratification routines to define pathways. In summary, these are:

1. **Landbase:** structure based criteria
2. **Coverstate:** structure based criteria (based on the provincial broad-cover group model)
3. **Seral Stage:** structure based criteria (a stand age class grouping)
4. **Tree species:** structure based criteria
5. **Matrix:** decision based criteria

A generalized flow and relationship between the criteria and pathways is provided in Figure 5. The structure criteria are based on specific stand structures while the decision matrix is

used to determine specific static and succession based pathways. Each of the above five-criteria is described in more detail in the following subsections.

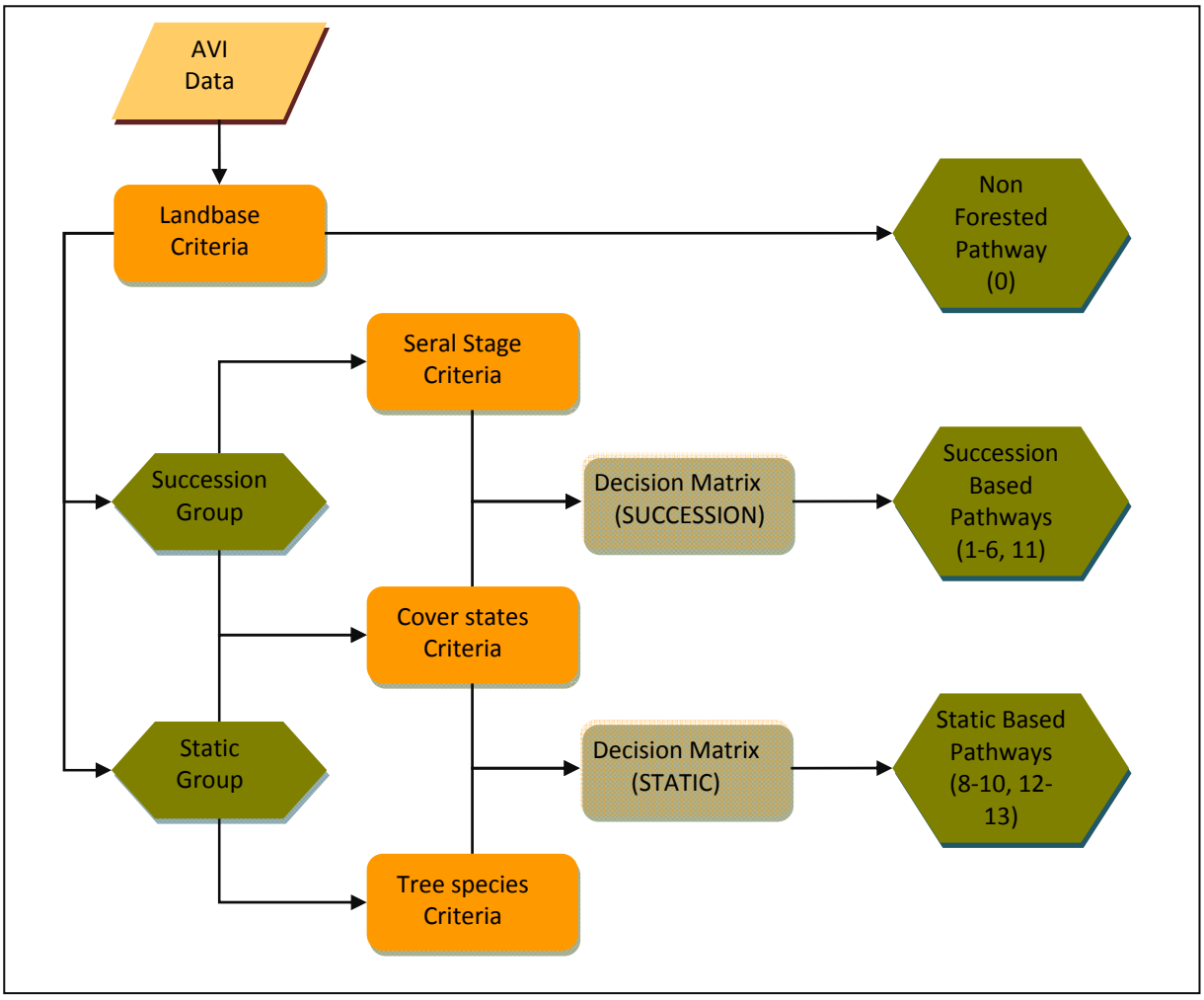


Figure 5. Generalized flow and relationship of criteria to the final pathways

3.1.1 Landbase Criteria

This set of criteria categorises the forest into three broad groups:

1. those stands that are non-forest
2. those stands that will be part of age-dependent (succession) based pathways
3. those stands that will comprise the age-independent (static) based pathways

The criteria are based on three variables calculated from the AVI attribute dataset:

4. **NF** (Non-Forested): A binomial variable differentiating stands that do "not" have trees in the overstory or understory (NF = 1) from stands that "have" trees in the overstory or understory (NF = 0)
5. **PXSBLT**: The total overstory tree species composition (to the nearest 10 percent) of aggregated pine species (PX), black spruce (SB) and larch (LT) (i.e., overstory pine species % + overstory black spruce % + overstory larch %)
6. **uPXSBLT**: The total understory tree species composition (to the nearest 10 percent) of aggregated pine, black spruce and larch (i.e., understory pine species % + understory black spruce % + understory larch %)

The resulting variables are then used to divide the land-base into three broad groups of stands:

7. **Non-forested stands:** (i.e., NF = 1)
8. **Succession Group:** Forested stands that did not have a significant proportion of pine, black spruce or larch or where the overstory was dominated by deciduous tree species (i.e., [NF = 0 and PXSBLT <= 20% and uPXSBLT <= 40%] or BCGo = "D")
9. **Static Group:** Forested stands that did have a significant proportion of pine, black spruce or larch and the overstory was not dominated by deciduous tree species (i.e., [NF = 0 and PXSBLT > 20% or uPXSBLT > 40%] and BCGo <> "D")

3.1.2 Coverstate Criteria

The coverstate classification is summarized in Table 5. The set of criteria that define coverstates is based on the provincial broad cover group classification (i.e., D, DC, CD, C). However, several refinements are made: First, the 'Cp' and 'Cd' coverstates represent a further stratification of 'C' stands. The C designation is used exclusively for the static based group while the Cp and Cd designation is used exclusively for the succession group. Secondly, stands with overstories dominated by deciduous tree species (D) and having coniferous tree species in the understory are assigned to one of three classifications (Du1, Du2, Du3), depending on the relative height difference between the overstorey and understorey.

Table 5. Coverstate classification.
Note that the 'Cp' and 'Cd' coverstates represent a refinement of the 'C' coverstate

LABEL	CRITERIA
C	>=80% of the overstory trees are coniferous species
Cp	100% of the overstory trees are coniferous species
Cd	80 to 99% of the overstory trees are coniferous species
CD	At least 50% of the overstory trees are coniferous species and at least 21% are deciduous species
DC	At least 50% of the overstory trees are deciduous species and at least 21% are coniferous species
Du1	At least 80% of the overstory trees are deciduous species and at least 6% cover of shade tolerant coniferous tree species (Sw, Sb, Fb) in the understory that are between 3 and 6 meters of the overstory height.
Du2	At least 80% of the overstory trees are deciduous species and at least 6% cover of shade tolerant coniferous tree species (Sw, Sb, Fb) in the understory that are between 6 and 9 meters of the overstory height.
Du3	At least 80% of the overstory trees are deciduous species and at least 6% cover of shade tolerant coniferous tree species (Sw, Sb, Fb) in the understory that are greater than 9 meters of the overstory height.
D	At least 80% of the overstory trees are deciduous tree species and less than 6% cover of conifer trees in the understory.

3.1.3 Seral Stage Criteria

Table 6 summarizes the seral stage classification. Seral stages are based on AVI age, which is the stand (polygon) age calculated from the overstory stand-origin field (AEP 1991). In conjunction with the coverstate criteria seral stages represent the defining construct of the succession model used to delineate the succession based pathways.

Table 6. Seral stage classification

SERAL STAGE	CRITERIA
1	AVI age > 0 and < 30 years
2	AVI age >= 30 and < 70 years
3	AVI age >= 70 and < 110 years
4	AVI age >= 110 and < 150years
5	AVI age >= 150 years

3.1.4 Tree species Criteria

Tree species criteria are used to further subdivide stands according to meaningful tree-species relationships. Specifically, it further subdivides conifer dominated stands in the 'Static' group. The following variables are calculated from the tree species compositional information found in the AVI attribute data:

- **tPX** = the total proportion of pine species in the combined overstory and understory
- **tSB** = the total proportion of black spruce in the combined overstory and understory
- **tLT** = the total proportion of larch in the combined overstory and understory
- **tSW** = the total proportion of white spruce in the combined overstory and understory
- **tFB** = the total proportion of balsam fir in the combined overstory and understory

3.1.5 Decision Matrix

The succession based pathways defined using the decision matrix is summarized in Table 7. Using a combination of coverstates and seral stages the matrix is the driving criteria for the succession based pathways and together, reflect the succession model developed specifically for AVI data. In its simplest form there are three defining characteristics of the succession model:

1. **Coverstates change over time:** Although this appears not so true for Pathway 6 and not at all for Pathways 1 and 11, as these pathways appear static, it is important to note that all stands in the succession group are parts of an original whole sorted by succession rules. Thus Pathway-1 is not the same as say, the static Pathway-7 (Pine) since this pathway includes stands having coniferous understorey and stands having

no coniferous understorey, while Pathway-1 represents only stands with no coniferous understorey.

2. **The model is deterministic:** All stands having the same coverstate, regardless the stand age, are on the same trajectory. Although much of the literature is concerned with the stochastic reality of replacement and convergent dynamics it would be impractical, and with the coarse level AVI data used, nearly impossible, to model succession stochastically into a meaningful and working stratification for Growth & Yield. This impracticality would manifest quickly once Timber Supply Analysis is carried out, which is of itself a "what-if" modeling system. Furthermore, the coarseness of the model, and its simplicity, reflects the relative simplicity of succession itself in the Boreal region, which is more deterministic when compared to other forested regions of the world.

   Mixedwood stands are converging to Pathway-6: Pathway-6 "White Spruce>>White Spruce" is the convergent pathway and hence the eventual coverstate, for the mixedwood pathways 2, 3, 4 and 5. Therefore, over time, these pathways will deterministically change coverstate to equal that of Pathway 6. However, this will occur at different times (or age-classes) with the lower numbered pathways converging later then the higher numbered pathways. Also, because Pathway 5 converges to Pathway 6 earlier and at the younger stand ages captured by the AVI, the pathway shares same coverstate 'Cp' at the last seral stage. If enough older stands were captured by the AVI, Pathways 2, to 4 would be shown in Table 7 to converge on Pathway 6 as well.

Table 7. Decision matrix for the succession based pathways.
Numbers in bold-brackets reference the section pertaining to the structure-criteria. N/A means that the structure criteria were not applied to that particular pathway. PB is the percent of balsam poplar in the overstory and further subdivides D stands into Pathways 1 & 11

	SERAL STAGE (class/years)					PATHWAY	
	1 0 – 29	**2** 30 – 69	**3** 70 – 109	**4** 110 – 149	**5** 150+	No.	Label
COVERSTATE	D	D	D	D	D	1	Aspen >> Shrub (PB <=20%)
						11	Balsam Poplar >> Shrub (PB > 20%)
	Du3	Du3	Du3, Du2	Du3, Du2, Du1	Du3, Du2, Du1, DC	2	Aspen >> White Spruce
	Du2	Du2	Du1	DC	CD	3	Aspen>>Late Mixedwood >>White Spruce
	Du1	Du1	DC	CD	Cd	4	Aspen>>Early Mixedwood >> White Spruce
	DC	DC	CD	Cd	Cp	5	Aspen Leading Mixedwood >> White Spruce
	CD, Cd, Cp	CD, Cd, Cp	Cd, Cp	Cp	Cp	6	White Spruce >> White Spruce

The static based pathways defined using the decision matrix is summarized in Table 8. The distinguishing characteristic of the static based pathways versus the succession based ones is the absence of seral-stages criteria and usage of individual tree species criteria. Thus, Pathways 8 & 9 for example, always remains CD and DC, respectively, regardless of the stand age.

Table 8. Decision matrix for the static based pathways.

Numbers in bold-brackets reference the section pertaining to the structure-criteria.
N/A means that the structure criteria were not applied to that particular pathway

COVERSTATE	TREE SPECIES	PATHWAY	
		No.	Label
DC	N/A	9	Deciduous-Pine-Black Spruce
CD	N/A	8	Pine-Black Spruce-Deciduous
C	tPX>= 80%	7	Pine
	tSW+tFB >= 20% and tPX >= tSB+tLT	10	Pine-White Spruce
	tSW+tFB < 20% OR tSW+tFB >= 20% and tPX < tSB+tLT	12	Black Spruce-White Spruce
	tSB+tLT >= 80%	13	Black Spruce

4.0 VOLUME SAMPLING

Under ideal sampling conditions, volume sampling plots would be allocated after the AVI and active landbase were completed for the entire FMA area. Because this was not feasible at the time, plots were allocated prior to completion or shortly after completion on an FMU basis: The entire TSP-1999 plots were established in FMU F1 prior to the new 2005-AVI being completed. Because the TSP-2005 sampling program was based on a 'random' allocation process the 2005-AVI was required to be completed before these plots were established. Therefore, plots from the TSP-2005 program were randomly allocated using the new 2005-AVI. Because the PSP-2005 sampling program was based on a systematic design, plots could be established on the old 1999-AVI as well as the new 2005-AVI. This was the case as the PSPs were allocated on the new 2005-AVI for FMU's P3, P10 and P13, but on the original inventories for FMU's F1, P4, P5 and S15.

4.1 SAMPLE DISTRIBUTION

4.1.1 Plots Netted out

A total of 691 plots were originally located in DMI's FMA area. However, a total of 74 plots were removed prior to modelling (Table 9). Almost all plots (73 out of 74) were removed because they fell in the newly defined inactive landbase. Due to time constraints, plots were allocated well before the active landbase was completed and, in order to retain important sampling theory assumptions, it was done so knowing that some would later be removed after the active landbase was finalized. The remaining plot (PSP-6119) was removed because the tree tally information was lost by the field surveyors (Row-II in Column-1 in Table 9, below). Since this was a PSP the tree tally data will be recollected at a re-measurement.

Table 9. Plots removed from the initial sample population

(1) DESCRIPTION	(2) NO. OF PLOTS
Total plots initially established	691
I. Number of plots deleted due to lost tree tally information	(1)
II. Number of plots deleted due to redefined water course buffers	(13)
III. Number of plots initially established in active Pathway but later fell in an inactive pathway (Pathway 0 or Pathway 13) after the AVI was completed	(6) *
IV. Number of plots deleted due to later defined subjective deletions: 'A' density overstorey's no understorey; or TPR = 'U' sites	(29)
V. Number of plots deleted due to redefined inoperable slopes	(10)
VI. Number of plots deleted due to redefining of FMA boundaries	(8)
VII. Number of plots deleted due to land use shifts	(5)
VIII. Number of Plots deleted due to newly defined swan nesting areas	(2)
Total plots removed from Sample	*(74)*
Total remaining plots	**617**

**Plots falling under this category were all PSPs, which were established on a grid prior to the AVI being completed.*

4.1.2 Final Sample Distribution

The sample distribution for each pathway is presented in Table 10. The spatial distribution, by sampling program, is presented in Figure 6. The majority of plots were allocated across two important pathways, Pathways 1 and 6. The mixedwood pathways also have adequate distribution.

Table 10. Number of sample plots by Pathway for the East-side, West-side and Total

(1) PATHWAY		(2) NUMBER OF PLOTS			
No	Label	East Side	West Side	Total	% of Total
1	Aspen >> Shrub	86	21	107	17.3%
2	Aspen >> White Spruce	36	19	55	8.9%
3	Aspen >> Late Mixed >> White Spruce	37	18	55	8.9%
4	Aspen >> Early Mixed >> White Spruce	26	21	47	7.6%
5	Mixedwood >> White Spruce	35	19	54	8.8%
6	White Spruce >> White Spruce	55	29	84	13.6%
7	Pine	24	24	48	7.8%
8	Pine-Black Spruce-Deciduous	9	15	24	3.9%
9	Deciduous-Pine-Black Spruce	11	19	30	4.9%
10	Pine-White Spruce	9	31	40	6.5%
11	Balsam Poplar >> Shrub	22	3	25	4.1%
12	Black Spruce-Pine/White Spruce	17	31	48	7.8%
	Total:	*367*	*250*	*617*	*100%*

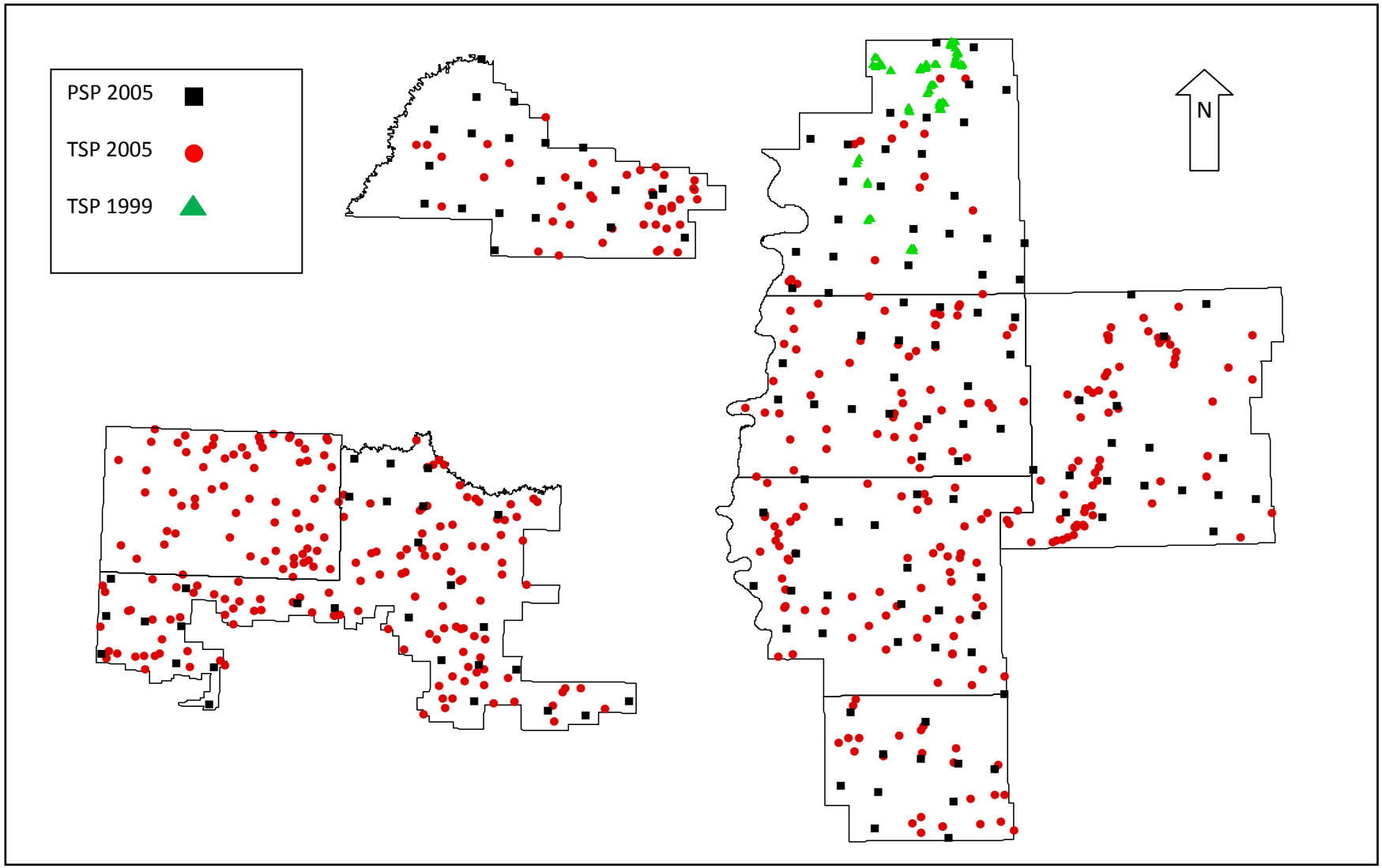


Figure 6. Spatial Distribution of Volume Sampling Plots

Includes all 691 plots initially established and all subplots of the TSP-1999 sampling program

4.2 SAMPLING ERROR

Deciduous and coniferous yield sampling error was calculated across the FMA (Table 11) and for each Pathway (Table 12) using the following two equations, respectively.

[1] $$E = \frac{t \cdot s}{\sqrt{n}}$$

Where: *E* = *actual error*
t = *the t-value at 95% probability*
s = *standard deviation*
n = *number of observations;*

[2] $$E_i = \frac{t_i \cdot s_i}{\sqrt{n_i}}$$

Where: *E* = *actual error*
t = *the t-value at 95% probability*
s = *standard deviation; n = number of observations*
i = *the i^{th} pathway from 1 to 12.*

Table 11. Deciduous and coniferous yield sampling error across the total FMA

(1)	(2) DECIDUOUS YIELD			(3) CONIFEROUS YIELD		
NO. OF PLOTS	mean (m^3/ha)	std (m^3/ha)	error (+/-%)	mean (m^3/ha)	std (m^3/ha)	error (+/-%)
630	98.9	109.5	8.6	105.2	123.3	9.6

Table 12. Deciduous and coniferous sampling error for each pathway

(1) PATHWAY		(2)	(3) DECIDUOUS YIELD			(4) CONIFEROUS YIELD		
No.	LABEL	N	mean (m^3/ha)	std (m^3/ha)	error (+/-%)	mean (m^3/ha)	std (m^3/ha)	error (+/-%)
1	Aspen >> Shrub	106	195.2	110.5	21.0	18.8	41.5	7.9
2	Aspen >> White Spruce	56	181.0	121.8	31.9	55.3	84.2	22.1
3	Aspen >> Late Mixed >> White Spruce	55	153.0	108.9	28.8	87.6	110.4	29.2
4	Aspen >> Early Mixed >> White Spruce	47	111.5	80.7	23.1	152.7	102.8	29.4
5	Mixedwood >> White Spruce	70	56.7	70.4	16.5	165.0	132.8	31.1
6	White Spruce >>White Spruce	84	54.9	69.7	14.9	204.6	171.6	36.7
7	Pine	48	21.6	43.7	12.4	140.3	100.6	28.5
8	Pine-Black Spruce-Deciduous	24	32.2	49.1	19.6	62.4	67.4	27.0
9	Deciduous-Pine-Black Spruce	28	72.2	93.0	34.4	85.4	85.6	31.7
10	Pine-White Spruce	40	55.4	95.5	29.6	157.3	112.9	35.0
11	Balsam Poplar >> Shrub	25	141.6	113.4	44.5	18.4	36.3	14.2
12	Black Spruce-Pine/ White Spruce	47	4.1	12.6	3.6	65.7	76.0	21.7
Total		630*						

**The total 630 plots includes plots replicated in Pathway-5 (due to succession convergence with Pathway-6) and plots removed from the growth and yield modelling (See Section 6.3.2 below)*

4.3 FMU DISTRIBUTION

Because most plots were allocated before the inventory was completed, it is important to ensure that the sample adequately represents the entire landbase. To examine this, the distribution of plots was compared to the distribution of active landbase across FMU (Table 13). Results show that the landbase as a whole was properly sampled as no major proportional differences (highest difference is in P1S at 2.1%) between the relative plot sampling and FMU distribution (See Column-4, Table 13).

Table 13. Actual Sample Distribution compared to active landbase by FMU

(1) FMU	(2) ACTUAL SAMPLE Sample Area (m^2)	(2) ACTUAL SAMPLE % of Total Sample Area	(3) ACTIVE LANDBASE Landbase Area (ha)	(3) ACTIVE LANDBASE % of Total Landbase Area	(4) DIFF
F01	34,450	15.5%	215,504	14.7%	0.8%
P02	34,000	15.3%	217,566	14.8%	0.5%
P03	11,800	5.3%	98,120	6.7%	-1.4%
P04	28,800	13.0%	185,265	12.6%	0.4%
P05	24,200	10.9%	186,005	12.7%	-1.8%
S15	29,800	13.4%	185,531	12.6%	0.8%
P10	20,600	9.3%	152,323	10.4%	-1.1%
P11	1,200	0.5%	8,823	0.6%	-0.1%
P1N	21,000	9.5%	144,058	9.8%	-0.3%
P1S	16,200	7.3%	76,309	5.2%	2.1%
Total	*222,050*	*100%*	*1,485,906*	*100.0%*	

4.4 STAND AGE

As per the Framework Document (Section 11.7) the relationship between Inventory Age and plot age would be understood and presented prior to conducting the timber supply analysis. This was done by comparing the stand age calculated from AVI origin (referred to in this section as the FMA age) to the stand age calculated from the plot data (referred to in this section as the Plot Age).

Although one assumption of this exercise would be that each plot level AVI age equals the Plot Age, the subjective biases behind both estimates plus the fact that AVI interpretation was conducted at a different scale than plot sampling meant that there would always be a degree of variability expected. What was important however, since growth and yield modeling and timber supply analysis are landscape level exercises, was that the means between the two ages approximate each other. Any gross discrepancies between the

expected means should be noted, attempted to be rationalized, fixed if possible; but in the least, known when conducting a future timber supply analysis.

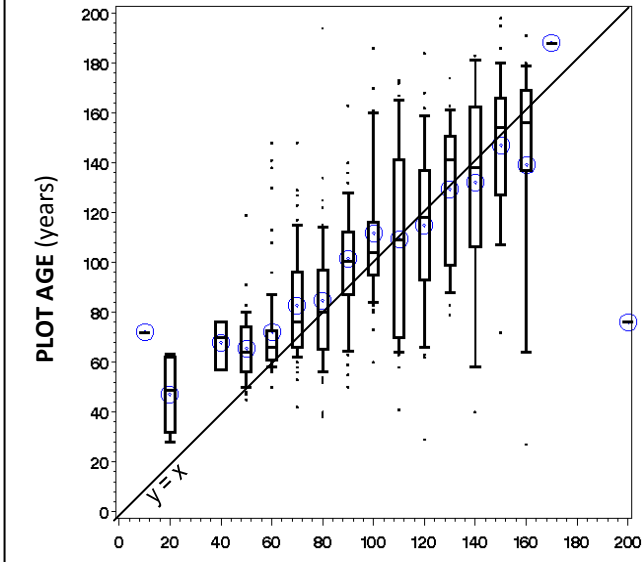
Methods

Plot age was determined from the same sample plot data (specifically the Site-Index data - refer to the Framework Document for the sampling methods) used to develop the growth and yield models. Plot age simply represented the oldest tree sampled for age from each plot.

The inventory age was calculated from the overstory origin data stored in the AVI attribute database. The two ages were compared using box-plots and regression techniques (See next section).

Results/Conclusions

At the landscape level, the inventory age was predicting the plot age within a reasonable amount of tolerance. Although there was a high degree of variability, especially in the older age classes, the expected line was running relatively close to the median (center line of each box-plot) and within 10 years of the mean (Figure 7). This was substantiated by the moderately high r-square that was obtained for the entire sample dataset (r^2=0.3887, n=545) and, even more importantly, the high r-square obtained for the 10-year means (r^2 = 0.9639).



Regression Statistic (AVI Age = Plot Age)

TYPE	R^2	RMSE	N
All plot data	0.3887	25.6	545
10-year means *(blue circles on graph left -note: excluded means less than 50 years and greater than 160 years due to low sample sizes)*	0.9639	6.8	13

Figure 7. Relationship between stand age estimated from the plot data versus stand age estimated from the inventory data using box-plots (hinges = 10%) and regression techniques.

Blue circles with centre dot plot the 10-year means. R^2 is adjusted. RMSE = Root Mean Square Error; N= sample size. N (545) is less than total sample available due to missing tree ring counts.

4.4.1 Quality Control Audits

Quality control audits were conducted for both the PSP-2005 and TSP-2005 sampling programs. Refer to the Framework document for details on the quality control procedures. Originally, plots were to be selected for audit randomly. This was done for the first audit but abandoned due to time/cost constraints. It was felt that a larger number of audited plots subjectively selected would be better than fewer, randomly selected audited plots. Therefore, audit plots were later selected based on access and proximity to one-another.

Plots were established on the ground or in the air and subsequently audited using ground and air transportation, respectively.

Table 14 and Table 15 summarize the audit of the TSP-2005 and PSP-2005 sampling programs, respectively. Six different contractors were used, identified using number codes in

Column 3 for both tables. The two most important aspects of the plot establishment were plot location and the tree-tally, both of which were scored severely. The contractor would fail the plot if the plot location procedures were not followed or if one tree was erroneously added or missed.

Audit Results (Synopsis)

All plots audited were located correctly: all were in the right stand and plot movement protocols were followed. However, several plots had tree tally errors; missed or added trees. In certain cases, tree tally errors were severe enough that the contractor failed the audit. As per the audit procedures, tree tally errors were fixed by the auditor and a second audit was conducted after the contractor was given time to check the remaining plots in the audit-population. In only one case, did a contractor fail the first and second audit (See Audit Code '0708' in Table 15).

One set of plots, comprising of 5 TSPs in total, were not included in any audit (See Column (1) Audit Code = 'ADDED' in Table 14) population due to the length of time between allocation and final establishment. The plots were added between April, 2007 and October, 2007 to shore up the last seral stage of Pathway 2 "Aspen>>white spruce".

Table 14. Audit summary for the TSP-2005 sampling program.
Contractors have been identified by unique numbers (Column 3). Column 7 represents trees that were missed by the subcontractors. Column 8 represents the number of trees that were added to the tree tally but where out of the plot or too small

(1) AUDIT CODE	(2) DATE	(3) CON-TRACT.	(4) # OF PLOTS IN POP.	(5) # OF PLOTS AUDITED	(6) AUDIT STATUS	(7) NO. MISSED TREES	(8) NO. ADDED TREES	(9) NO. PLOT LOC. ERRORS	(10) COMMENTS
0511 – Preliminary*	Nov, 2005	1	3	3	Failed	4	0	0	All plots were fixed
		2	3	3	Passed	0	0	0	
0512	Dec, 2005	1	17	6	Failed	2	2	0	Contractor visited and fixed all plots
			2nd Aud	6	Passed	1	0	0	
0601	Jan, 2006	1	18	6	Passed	0	2	0	The two added trees were dec. snags that were recorded live.
		2	27	6	Passed	0	0	0	
0602	Feb, 2006	1	22	3	Passed	0	1	0	Added tree was a small diameter (12cm dbh) pine tree
		2	34	4	Passed	0	0	0	
0603	Mar, 2006	1	27	6	Passed	0	0	0	
		2	22	5	Passed	0	0	0	
0611	Nov, 2006	1	21	4	Passed	0	0	0	
0701	Jan, 2007	1	34	4	Passed	0	0	0	
0704	Apr, 2007	1	47	8	Passed	1	0	0	One small diameter (9.3 cm) Pb missed.
ADDED	May, 2007	1	5	0	Not Audited	0	0	0	Was not included in

(1) AUDIT CODE	(2) DATE	(3) CON-TRACT.	(4) # OF PLOTS IN POP.	(5) # OF PLOTS AUDITED	(6) AUDIT STATUS	(7) NO. MISSED TREES	(8) NO. ADDED TREES	(9) NO. PLOT LOC. ERRORS	(10) COMMENTS
									any audit population.
0709	Oct, 2007	1	44	6	Passed	0	0	0	
0801-Preliminary*	Jan,2008	3	7	5	Passed	0	1	0	Added tree was a 13.3 cm diameter Sw
0802	Feb, 2008	3	20	5	Passed	1	0	0	Missed a 13.9 cm diameter Sb.
		1	17	5	Passed	0	0	0	
		4	17	4	Passed.	1	0	0	Missed a 25.5 cm aspen tree in one of the last three plots audited
0803a	Mar, 2008	1	34	4	Passed	0	0	0	
		4	23	6	Failed	3	0	0	Many missed tree species calls:
			2nd Aud	3	Passed.	0	0	0	
0803b	Mar, 2008	4	14	6	Passed	0	0	0	
		TOTAL	*456*	*108*		*13*	*6*	*0*	

**Denotes sample orientation stage*

Table 15. Audit summary for the PSP-2005 sampling program.
Contractors have been identified by unique numbers (Column 3); numbers that correspond to the contractor numbers in Table 14 above are the same crew. Column 7 represents trees that were missed by the subcontractors. Column 8 represents the number of trees that were added to the tree tally but where out of the plot or too small.

(1) AUDIT	(2) DATE	(3) CON-TRACT.	(4) # OF PLOTS IN POP.	(5) # OF PLOTS AUDITED	(6) AUDIT STATUS	(7) NO. MISSED TREES	(8) NO. ADDED TREES	(9) NO. PLOT LOC. ERRORS	(9) COMMENTS
0606	Jun, 2006	2	8	2	Passed	0	0	0	*No* Missed or Added Trees
0608	Aug, 2006	2	28	2	Passed	0	0	0	*No* Missed or Added Trees
0610	Oct, 2006	2	31	3	Passed	0	0	0	*No* Missed or Added Trees* Note that actual raw audit data is missing but it is known that no trees were missed or added.
0708	Aug, 2007	5	26	5	Failed	2	0	0	Also some missed species identification Pb called Aw in this population and the vegetation and soil collection was erroneous.
		2nd Audit		4	Failed	2	0	0	Also some missed species identification Pb called Aw in this population.
		3rd Audit		5	Passed	0	0	0	*No* Missed or Added Trees
0709	Oct, 2007	5	14	6	Passed	1	0	0	Missed a 21.2 cm dbh Sw tree in plot 6066.
		1	23	7	Passed	0	0	0	*No* Missed or Added live Trees. Missed a snag in plot 6039.
		6	14	4	Passed	1	0	0	Missed a 20.1 cm Fb tree. Rest of the data collection was good.
		TOTAL	*146*	*38*		*6*	*0*	*0*	

No audit reports were generated for the F1-TSP-1999 sampling program.

4.4.2 Tree Tally Audit Summary

Audit tree-tally measurements were directly compared to the field tree-tally measurements for both continuous variables and discrete variables, respectively.

Audits showed that the continuous variables Breast-Height, DBH, Tree Height and Height-to-crown were within acceptable differences (Table 16). Not surprisingly, height to crown (Column 4) showed the highest degree of error, reflecting the high degree of subjectivity inherent with this variable.

Table 16. Audit summary comparing field and audit mean values for four continuous variables collected in the tree tally form

(1) MEAN BREAST HEIGHT (M)			(2) MEAN DBH (CM)			(3) MEAN TREE HEIGHT (M)			(4) MEAN HEIGHT TO CROWN (M)		
Field	Audit	Diff	Field	Audit	Diff	Field	Audit	Diff	Field	Audit	Diff
1.2942	1.2838	0.0103	19.5374	19.6256	-0.0882	17.1987	17.1386	0.0602	9.2092	8.8764	0.3328

Discrete variables were shown to be within acceptable error tolerances (Table 17) with maybe the exception of the Crown Class, which showed that only 89.4% of the crown classes assigned to trees was correctly classification. This was found to be the result of confusion by certain field surveyor's with discriminating between suppressed trees and intermediate trees. Most tree-species errors were between white and black spruce and where corrected when found by the auditors. Therefore the actual % correct of the overall sample would be expected to be higher.

Table 17. Audit summary of discrete variables collected in the tree tally form

(1) SECTION NUMBER		(2) TREE SPECIES		(3) CROWN CLASS		(4) CONDITION CODES	
% Correct	n	% Correct	n	% Correct	n	% Correct	n
95.1%	528	94.4%	906	89.4%	856	93.4%	3522

All tree-tally audit data was compiled and provided in Appendix-2 of this information package.

5.0 CULL DEDUCTION

Tree cull is the amount of unmerchantable fibre found within the tree bolt and was applied through a reduction of individual tree merchantable volume.

A cull volume estimation program was initiated in the spring of 2007 to determine the amount of additional tree volume (m^3) that would be reduced based on bolt decay. The work conducted for this program was guided by the Cull Estimation Plan (CEP) submitted to SRD and approved in August 2007. Refer to the CEP document for details regarding the methods and sampling procedures used noting changes made to the protocols since the plan was approved by ASRD (described in Section 5.2 below).

5.1 CULL DEDUCTION

Individual tree merchantable volume was reduced according to the cull deductions (in percent) presented in Table 18. The largest percent deduction was found with Aspen having Conks. No cull was found in aspen and coniferous trees that were non-suspect. Coniferous trees with conks & punk-knots were not sampled because none could be located in the field.

Table 18. Individual tree Cull-Suspect-Class percent deductions

(1) CULL SUSPECT CLASS (CSC)		(2)	(3)	(4)
Label	Description	ASPEN/BIRCH	BALSAM POPLAR	CONIFEROUS
C	Conks & Punk-knots	12.3%	1.5%	0%
O	Old broken tops	0.1%	1.5%	4.7%
S	Scars & other wounds	4.3%	1.5%	3.7%
N	Non Suspect	0%	1.5%	0%

5.1.1 Method summary

Advanced decay volume, insipient decay volume (decay in the transitional stage between stain and advanced decay), and total merchantable volume, all in cubic-metres, were

collected for each individual tree in the sample population as per the methods described in the CEP.

Advanced decay equated to cull volume for deciduous tree species. Both insipient and advanced decay equated to cull volume for coniferous tree species.

Cull represented a ratio in percent of decay volume to merchantable tree volume.

Table 19 shows the sample size achieved for the project. In total 206 trees were destructively sampled. This included 144 deciduous trees and 62 coniferous trees. Pine with conks and white spruce trees with conks were initially targeted for sampling but could not be found. This fact will not have any measurable effect on the growth and yield models since only 6 of the 14,437 conifer trees sampled (i.e., stored in the tree volume database) had conks, representing less than .0005% of the total trees.

Table 19. Number of trees sampled for four tree species by Cull Suspect Class (CSC).
See Table 20 below for details regarding CSC codes

(1) TREE SPECIES	(2) NO. OF TREES SAMPLED BY CSC				(3) TOTAL
	C	N	O	S	
Aspen	20	19	19	21	79
Balsam Poplar	5	20	22	18	65
Pine SPP.	0	7	11	8	26
White Spruce	0	15	9	12	36
Total	*25*	*61*	*61*	*59*	*206*

Tree condition codes, assigned to individual trees in the field prior to felling, were used to assign cull suspect class based on those presented in Table 20.

Table 20. Cull Suspect Class based on Condition Codes

(1) CULL SUSPECT CLASS (CSC)		(2) CONDITION CODE	
Label	Description	No.	Description
C	Conks & Punk-knots	15	Conks & Punk-knots
O	Old broken tops	7	Broken stem below merchantable top diameter
		8	Broken stem above merchantable top diameter
		22	Recovered top
S	Scars & other wounds	14	Frost crack, wind shake, spiral grain
		18	Open Scars
N	Non Suspect		All other condition codes

5.2 CHANGES MADE TO THE ORIGINAL SAMPLING DESIGN

Two changes were made to the original design described in the Cull Estimation Plan. The first change was already theorized and mentioned as a possible alternative method in the CEP. The second one concerned tree species groupings. The two changes are summarized as follows:

(1) The project sampled individual trees based on cull-suspect class instead of the method originally proposed. It was realized after the first field shift that a larger than economically desired sample would be required to sample individual trees across the landbase and the project reverted back to the traditional method. Initially, it was desired to develop cull deduction tables based on landscape level stand height using the AVI map information (Paragraph 4 in the Cull Estimation Plan). However, it was theorized at the onset of this project that this type of sampling design could require a sample size that was not feasible economically and the sampling protocols were designed to account for this possibility.

(2) Spruce and Pine were aggregated into one conifer cull estimation. The purpose of this was to increase the sample size for both pine and spruce, which it was felt, were under sampled. Combining the sample enabled more accurate estimates.

5.3 SAMPLE VARIANCE ANALYSIS

As per the CEP document (See Section 2.0 of the CEP document), the sampling error was targeted not to exceed +/- 20% at the 95% probability level.

The error was calculated using Equation [1], above. The standard deviation ('s' in Equation-1) represented the total whole-tree decay (insipient + advanced) volume proportion to the total whole-tree merchantable volume was used.

Results are provided in Table 21 and show that the sampling error target was met for all tree species (Column 8).

Table 21. Percent cull summary statistics plus calculated error (using Equation 1) for Aspen (Aw), Balsam poplar (Pb) and Coniferous (CONIFER) tree species over Cull Suspect Class (CSC).

The proportion of advanced decay volume to total tree volume was used as the input variable for Aw & Pb. The proportion of total decay volume (insipient + advanced) was used as the input variable for Conifer

(1) TREE SPECIES	(2) CSC	(3) N	(4) MEAN	(5) STD	(6) LOW CLM	(7) HIGH CLM	(8) ERROR (%)
Aw	C	20	12.30	11.50	6.92	17.69	5
	N	19	0.01	0.032	-0.00549	0.025	0.5
	O	19	0.10	0.25	-0.02006	0.22	0.5
	S	21	4.29	5.94	1.58	6.99	3
Pb	All	65	1.52	3.11	0.75	2.29	1
CONIFER	N	22	0	0	0	0	0
	O	20	4.68	7.26	1.28	8.08	3
	S	20	3.70	7.54	0.17	7.23	3

5.4 CULL SENSITIVITY

The purpose of this section is to provide sensitivity information regarding the impact cull deduction have on DMI's merchantable volume estimate. A univariate analysis showed that the cull data was highly skewed to the left (Figure 8). As a result, the parametric based sample variance analysis described in Section 5.3 above, which showed that sample error targets were met, was suspect since the basic parametric assumption of normality was violated.

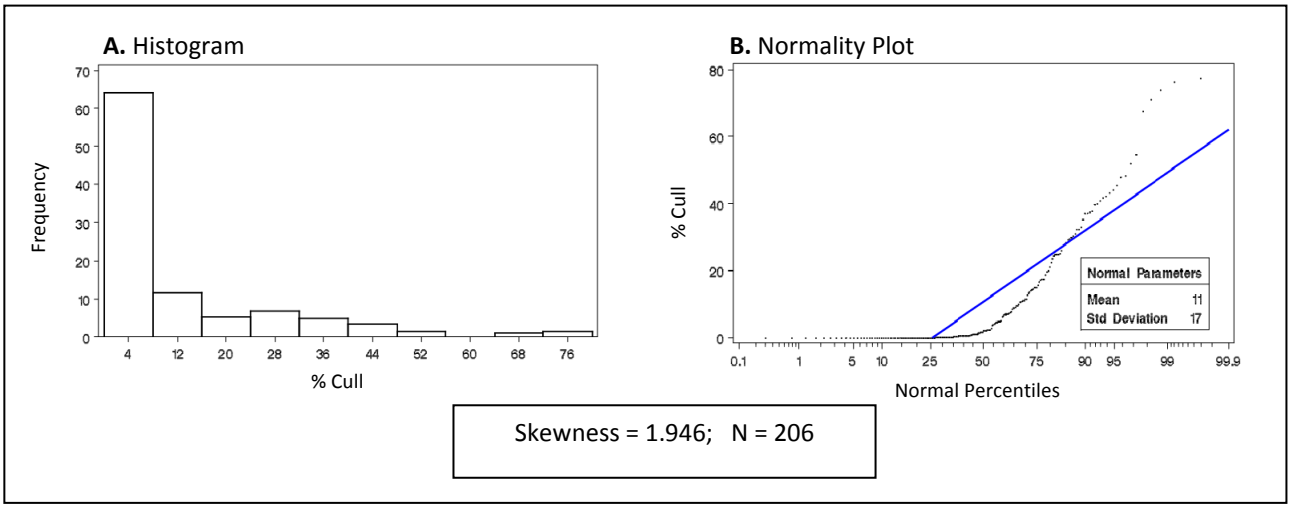


Figure 8. Univariate summary run on the proportion of Total Decay (advanced + Insipient) volume to total tree volume.

Merchantable volume was compared using three different cull factors:

- **No-Cull**: No cull deduction;
- **2005-Cull:** Cull deduction based on this program;
- **1999-Cull:** Cull deduction based on estimates used in the 1999 growth and yield tables.

Merchantable utilization volumes were compared directly using the 2005 tree volume data (See Section 2.2 for details) and using the tree species aggregates used in the sampling strategy described in Table 1 of the CEP.

5.4.1 Results

The cull factors for deciduous (using the Pathway-1 deciduous yield model) and for coniferous (using the pathway-6 coniferous yield model) were compared and are presented in Figure 9. The graphs clearly show that there was very little effect of the cull deduction on final yield. This was particularly true with the coniferous yield model.

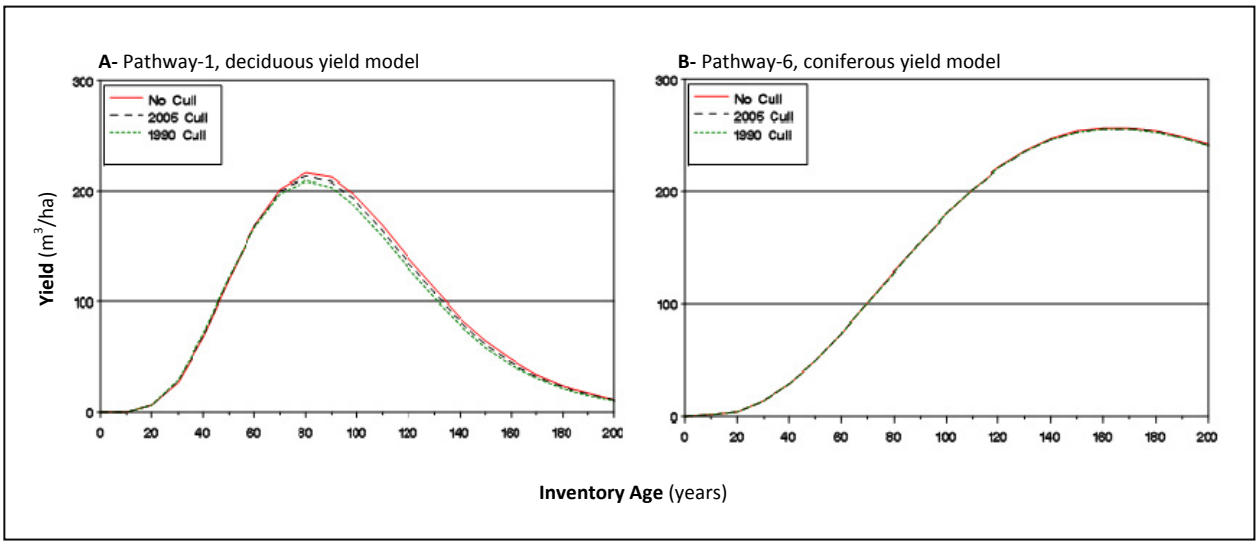


Figure 9. Effect different cull calculations have on two growth and yield curves: A, deciduous yield for Pathway 1 and B, coniferous yield for Pathway-6.

Cull calculations include: No cull deduction (red solid line), Cull deduction based on 2005 sampling program (black dashed line) and cull deduction based on 1999 sampling program (green dotted line)

The reason why cull deduction was having very little effect on final yield can be seen in the summary provided in Table 22. Here, the individual tree tally (bTREETALLY table in the tree-volume-database, see Section 2.2.2) data was queried and summarized for merchantable volume and number-of-trees, by cull-suspect-class. The majority of trees were in the non-suspect (i.e. CSC = 'N') class. This included 88% of the trees and 87% of the total merchantable volume sampled and stored in the database. This reason alone could account for the fact that the cull deduction tables calculated have very little impact on the final yields.

Table 22. Distribution of merchantable volume and number of trees by Cull-Suspect-Class

(1) CSC	(2) MERCHANTABLE VOLUME (M^3)	(3) % OF MERCHANTABLE VOLUME	(4) NO. OF TREES	(5) % OF NUMBER OF TREES
C	227	4	406	2
O	93	2	314	2
S	393	7	1,338	8
N	4,873	87	14,600	88
Total	*5,586*	*100%*	*16,658*	*100%*

5.4.2 Conclusions

Cull-deduction has very little influence on the yield models. Therefore, the fact that the sample distribution was not parametric, or normally distributed, should be of little to no consequence towards the final yield estimates used in timber supply analysis.

6.0 GROWTH AND YIELD MODELING

6.1 INDIVIDUAL TREE VOLUME ESTIMATION AND PLOT LEVEL YIELD COMPILATION

Merchantable volume was calculated for each individual tree stored in the tree volume database using the models and provincial-level parameter estimates provided by Huang (1994).

Merchantable length was defined by a 15/10 utilization standard for deciduous tree species and a 15/11 utilization standard for coniferous tree species. The minimum merchantable length allowed was 3.66 metres. Individual tree merchantable volume was further reduced, to account for cull, according to the percentages presented in Table 19 above.

6.1.1 Tree Heights

Under the TSP-2005 and PSP-2005 sampling programs, almost all live individual tree heights were estimated in the field using a hypsometer. Tree heights were not collected in the field for the majority of live trees sampled under the TSP-1999 sampling program. Tree heights were also not collected in the field for standing dead trees (snags) in any of the three sampling programs.

Tree heights not collected in the field were estimated using the Richards-Type height-diameter model described by Huang et al (1992) using the coefficient estimates developed by Huang (1994). Roughly 20% of individual trees stored in the tree volume database had heights estimated using this method, the majority of which were snags.

6.1.2 Plot level compilation

Plot level compilation was conducted in SAS (v9) and created several important variables stored in the z2PLOTVOL table of tree volume database (See section 2.0, above).

Merchantable yield was compiled for each tree species in each plot using the following equation:

[3] $$y_j = (\sum_{i=1}^{n} \mathrm{v})_j \cdot (10{,}000/a)_j$$

Where:
- y = *yield (m^3/ha)*
- v = *merchantable volume (m^3)*
- a = *plot area (m^2)*
- i = *i^{th} tree*
- j = *j^{th} plot*
- *10,000* = *the number of square meters in one hectare.*

Coniferous and deciduous merchantable yield values were compiled simply by adding respective tree-species designates.

Density[1] was also compiled for each tree species in each plot using the following equation:

[4] $$d_j = (\sum_{i=1}^{n} 1_i)_j \cdot (10{,}000/a)_j$$

Where:
- d = *density (stems/ha)*
- a = *plot area (m^2)*
- i = *i^{th} tree*
- j = *j^{th} plot*
- n = *total number of merchantable trees*
- *10,000* = *the number of square meters per hectare*

6.2 GROWTH AND YIELD MODELS

In 2008, Growth and yield tables were built for DMI's FMA that was at the time, one FMA including both the 'East-side' and 'West-side' FMU's. The tables were submitted to SRD in 2008 and during the review period, DMI's landbase was divided into two FMA's: one including all FMU's 'East' of the Peace River and the other including all FMU's 'West' of the Peace River. Therefore, SRD approved the yield curves under the condition that the curves be regionalized to the new FMU's.

Because plots were initially allocated to strata when there was just one FMA and because DMI could not incur the cost of additional sampling, an indicator (aka 'dummy variable')

[1] Note that density was not used in any other calculations presented in this report.

modeling approach (Bates and Watts 1998) was used to localize the curves to respective East and West sides. In summary, the curves are first built as before assuming one FMA, which ensures an accurate model form. Then, additional parameters are added to the model and plots located in the East-side FMA are forced into the model independent of plots located in the West-side FMA and vice versa. In this way, the model form does not substantially change. Instead the relative plot weights come into play and affect the model form in a way that is reflective of regional productivity. Details on the methods are provided below.

6.2.1 Methods

Two tree species groups were modeled for live-tree merchantable yield. For each plot, aspen, balsam poplar and white birch were classified 'Deciduous'. White spruce, black spruce, pine species, fir species and larch were classified 'Coniferous'. Live tree yield was summed according to this classification. Dead tree (snag) yield was not included with live yield.

Least squares regression was used to model merchantable yield (m^3/ha) for both coniferous and deciduous aggregates. The input data was the individual plot-level yields and not age-class average yields. The dependent variable was the inventory stand age (10 year age classes), which was calculated from AVI origin:

A variation of the sigmoid type function was used to model both coniferous and deciduous yield (Huang per. Com., 2001). This variation allowed for greater modeling control over the forecast region. The function is of the form:

[5] $$x = a \cdot y^b \cdot e^{-y/z}$$

Where:
- x = *yield (m^3/ha)*
- y = *inventory age (10-year age class)*
- a, b = *parameters to be estimated*
- z = *adjustment factor*

The adjustment factor '*z*' was varied by pathway to provide better model fits and more realistic expectations for yield forecasts past the temporal range of plot data. Values for 'z' are summarized in Table 23.

Table 23. Values for the adjustment factor 'z' used in Equation [5]

(1) PATHWAY	(2) CONIFEROUS MODEL	(3) DECIDUOUS MODEL
0	Not Modeled	
1	20	15
2	50	15
3	50	20
4	50	20
5	50	15
6	50	15
7	50	15
8	50	15
9	50	15
10	50	15
11	50	15
12	50	15
13	Not Modeled	

Indicator Model

Yield estimates were then regionalized to east-side and west-side models using the indicator modeling approach (Bates and Watts 1998). Coefficients estimates from the original growth and yield models were held constant through a second non-linear regression modeling exercise whereby an additional parameters are used to account for the relative productivity of the two FMA's. The equation can be expressed as follows:

[6] $$x = (a + y_1 x_1 + y_2 x_2) y^b e^{-y/z}$$

Where: x = *yield (m^3/ha)*
y = *inventory age (10-year age class)*
a, b = *initial parameters estimated during the first model run*
y_1, y_2 = *indicator parameters to be estimated*
x_1, x_2 = *indicator variables*
z = *adjustment factor*

Plot data located in the East-side FMA was used to estimate the y_1 parameter while plot data from the west-side was used to estimate the y_2 parameter. Thus, the indicator variables were set as follows:

East-side: $x_1=1$, $x_2=0$

West-side: $x_1=0$, $x_2=1$

The adjustment factor 'z' was <u>not</u> changed for any pathway.

6.2.2 Results

Parameter estimates and model fit statistics for both the coniferous and deciduous yield modeling are presented in Table 24 and Table 25, respectively. Figure 10 and Figure 11 provide graphical representation of the models. Importantly, only graphs based on Equation [5] above and using all the plot data assuming one FMA, are shown since this is what drove the primary coefficient estimates and hence, the model form.

Convergent criterion was met for all models. All models were significant at the alpha=0.05, except for the deciduous model of Pathway 12, which had a p-value of 0.0785. This is not a concern however because the deciduous component of Pathway 12, which was a conifer dominated pathway, represented a small percentage of the total yield.

Table 24. Coniferous Yield-Model summary for each Pathway.

All values are based on Equation [5], except for the indicator parameter estimates (y1, y2), which are based on Equation [6]. y1=East-side parameter estimate; y2=West-side parameter estimate.

(1)	(2) PARAMETER ESTIMATES				(3) SUM OF SQUARES				(4) MODEL STATISTICS	
PATH-WAY	a	b	y1	y2	Model	Error	Total	R^2	F Value	P Value
1	0.0000000000013	7.8135	-1.87653E-13	4.38478E-13	71,214	147,158	218,372	0.3261	25	0.0000
2	0.0000491278951	3.4916	-0.00000011972	0.00000018855	213,029	347,541	560,570	0.3800	17	0.0000
3	0.0000245182526	3.7065	-0.00000075944	0.00000228455	522,868	556,682	1,079,550	0.4843	25	0.0000
4	0.0000939687138	3.5090	-0.00000723105	0.00001143186	1,191,204	390,266	1,581,471	0.7532	69	0.0000
5	0.0002693027280	3.3070	0.00001579241	-0.00004247603	2,124,228	998,149	3,122,377	0.6803	72	0.0000
6	0.0006191882335	3.1933	-0.00002815814	0.00006327860	3,935,589	2,026,860	5,962,449	0.6601	80	0.0000
7	0.0591492018872	2.1563	-0.00739890024	0.00628920845	1,004,639	416,290	1,420,929	0.7070	56	0.0000
8	0.0000793902038	3.4976	-0.00003053073	0.00000979834	122,247	75,687	197,934	0.6176	18	0.0000
9	0.0092197511625	2.4742	-0.00163914597	0.00101022301	240,129	162,265	402,394	0.5968	19	0.0000
10	0.0002129510724	3.3815	-0.00002494058	0.00000376609	1,122,435	364,454	1,486,889	0.7549	59	0.0000
11	0.0000088334402	3.6378	0.00000053854	-0.00000883344	11,460	28,630	40,090	0.2859	5	0.0208
12	0.0001953563706	3.2570	0.00002397942	-0.00001218059	226,334	242,459	468,793	0.4828	21	0.0000

Table 25. Deciduous Yield-Model summary for each Pathway.

All values are based on Equation [5], except for the indicator parameter estimates (y1, y2), which are based on Equation [6]. y1=East-side parameter estimate; y2=West-side parameter estimate.

(1)	(2) PARAMETER ESTIMATES				(3) SUM OF SQUARES				(4) MODEL STATISTICS	
PATH-WAY	a	b	y1	y2	Model	Error	Total	R^2	F Value	P Value
1	0.00000045095	5.7896	-0.0000000004392	0.0000000016978	3,891,127	1,432,679	5,323,807	0.7309	141	0.0000
2	0.00000001351	6.5659	-0.0000000003820	0.0000000004753	1,725,784	592,191	2,317,975	0.7445	68	0.0000
3	0.00000725092	4.7932	0.0000006435301	-0.0000010616681	2,359,769	1,101,640	3,461,409	0.6817	57	0.0000
4	0.00001334530	4.5912	-0.0000008004976	0.0000007290321	594,614	289,818	884,432	0.6723	46	0.0000
5	0.00000176796	5.3041	0.0000002180918	-0.0000003953651	275,421	283,324	558,745	0.4929	33	0.0000
6	0.00000001904	6.2283	0.0000000063563	-0.0000000083297	248,707	407,939	656,646	0.3788	25	0.0000
7	0.00000000000	7.9076	-0.0000000000002	0.0000000000002	24,624	87,429	112,053	0.2198	6	0.0033
8	0.00000849771	4.6970	0.0000000732284	-0.0000000443655	24,895	55,471	80,366	0.3098	5	0.0169
9	0.00000000368	6.6772	0.0000000000723	-0.0000000000363	190,400	189,174	379,574	0.5016	13	0.0001
10	0.00000007688	5.9231	-0.0000000436670	0.0000000100328	133,428	345,148	478,576	0.2788	7	0.0020
11	0.00000000006	7.7145	-0.0000000000015	0.0000000000139	504,139	305,459	809,598	0.6227	19	0.0000
12	0.00000000063	6.4156	0.0000000008917	-0.0000000004119	871	7,272	8,143	0.1069	3	0.0785

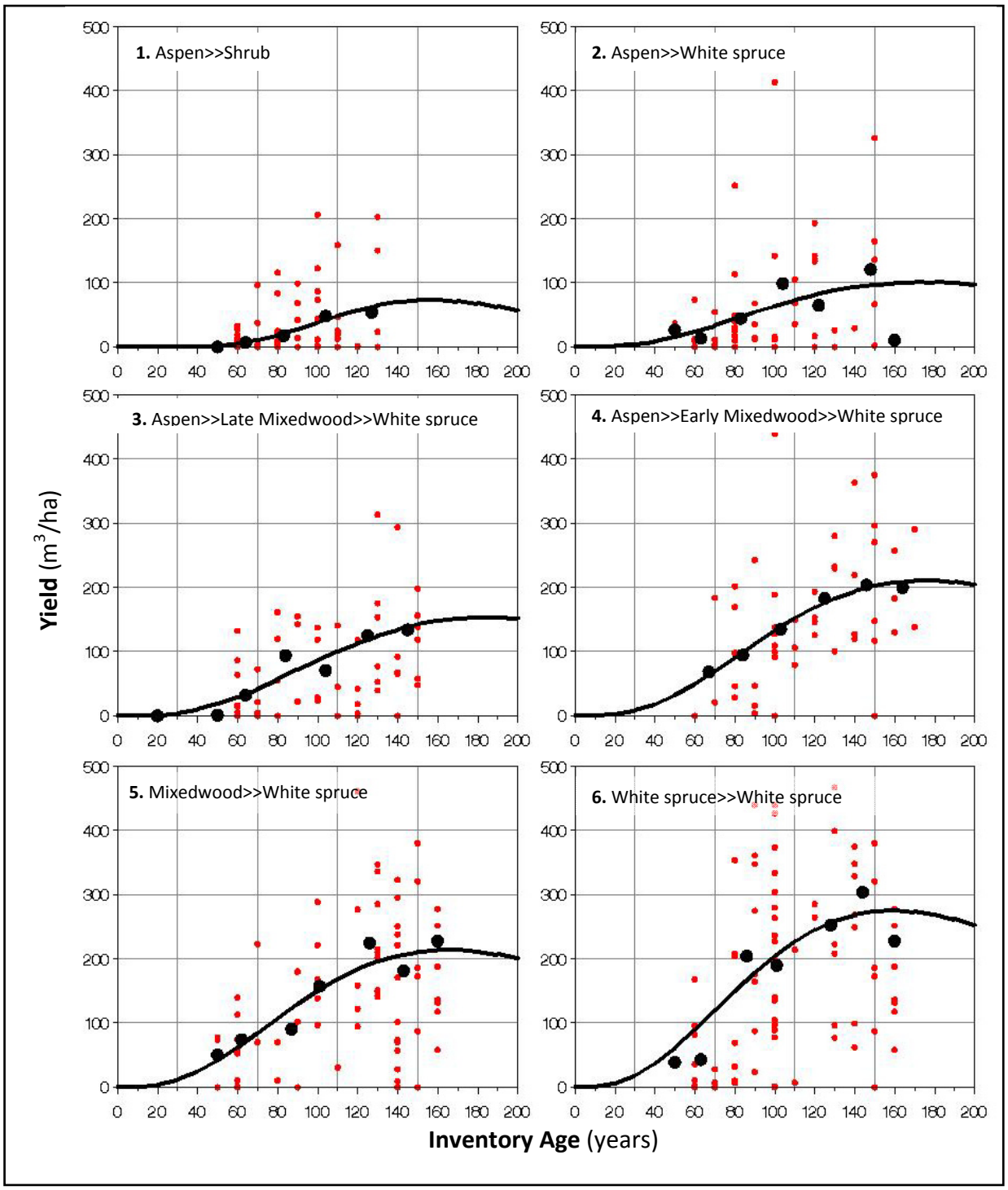
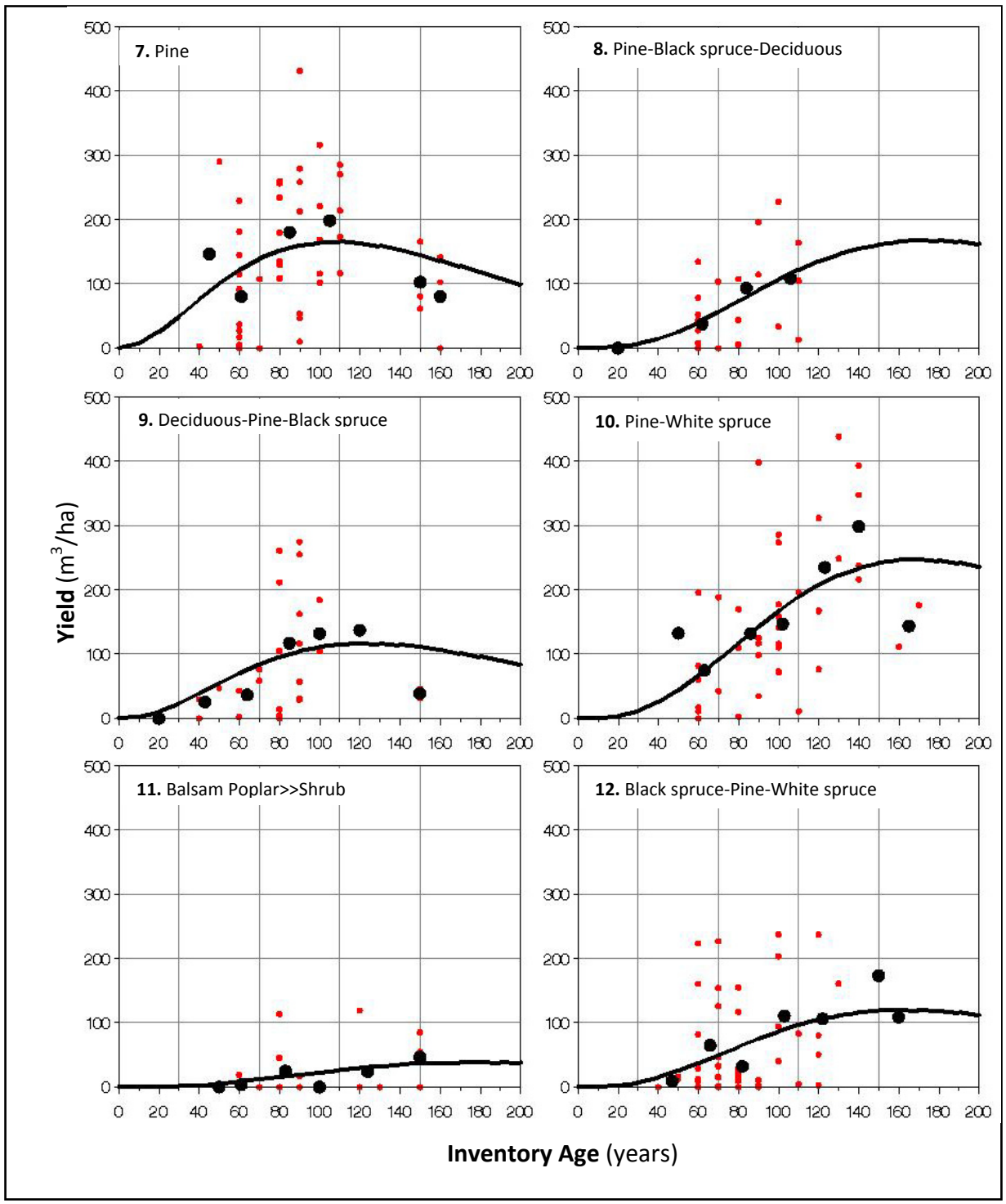


Figure 10. Coniferous Yield Curves

Solid, bolded black lines represent the predicted values based on least square regression modeling; smaller red dots are the plot level yields; larger black dots represent the average yield and inventory age calculated for specific age classes based on seral stage criteria; grey vertical lines delineate the age class



Coniferous Yield Curves Cont'd.

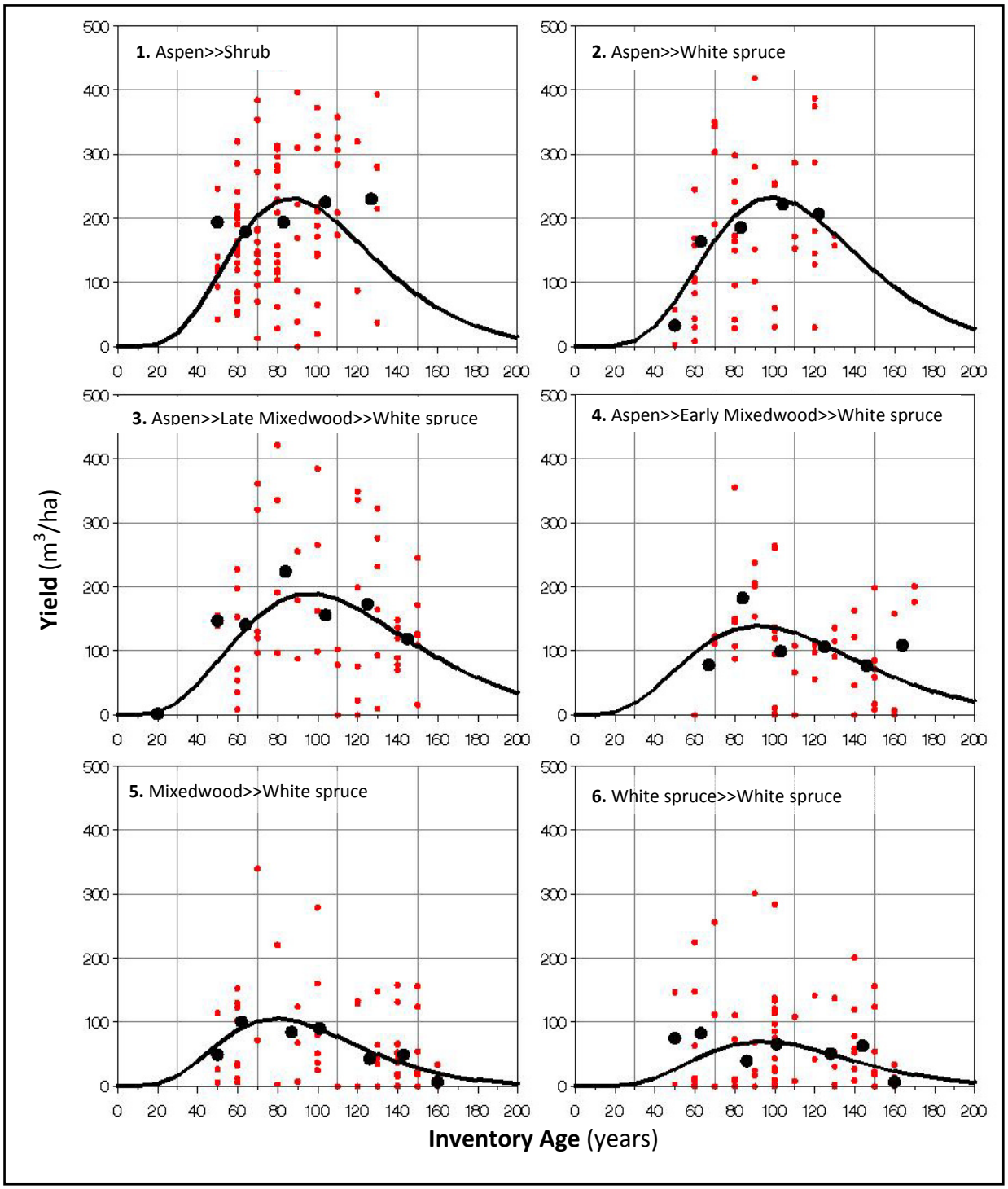
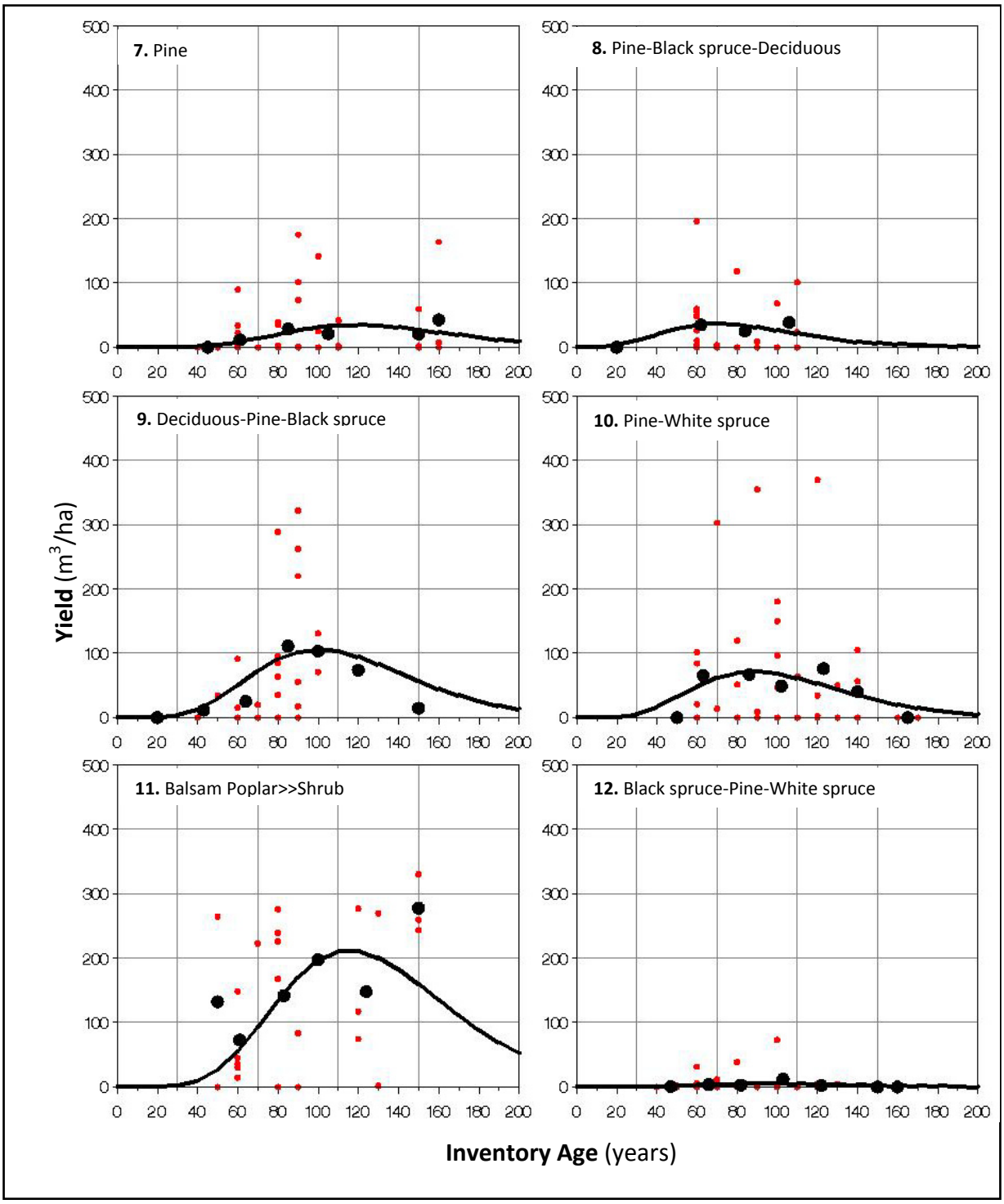


Figure 11. Deciduous Yield Curves

Solid, bolded black lines represent the predicted values based on least square regression modeling; smaller red dots are the plot level yields; larger black dots represent the average yield and inventory age calculated for specific age classes based on seral stage criteria; grey vertical lines delineate the age class



Deciduous Yield Curves Cont'd.

6.3 TOTAL SAMPLE PLOTS USED IN MODELING

6.3.1 Plot Sharing

Succession based growth and yield modelling will require plot sharing if young, compositionally different stand-types converge to compositionally similar stand types within the range of plot data. This occurs for Pathway-5, which converges to Pathway-6 after 150 years. Thus, the 18 (400 m^2) plots established in white-spruce (fir) dominated stands after 150 years are used to drive the yield estimates for the two pathways.

6.3.2 Plot Modification

A total of 630 plots were available for the growth and yield models (See Section 4.1). Of these, 9 plots were modified prior to running the models based on professional judgement (Plot modification summary). In 10 of the 11 cases the modification was made either to the deciduous volume or the coniferous volume but not both. In one case the plot was removed.

Table 26. Plot modification summary

(1) PATHWAY	(2) MODIFICATION	(3) NO. OF PLOTS	(4) COMMENTS
1	Changed conifer volume to equal zero	1	This plot caused higher than expected growth and yield at older stand ages. Value was set to zero because this provided a more realistic forecast than simply removing the volume.
2	Removed deciduous volume	7	All plots established in stands with ages 150 years or greater had deciduous volume removed. There were high deciduous volumes in these plots causing higher than expected yield that consequently caused the growth and yield curve to lag more than what was felt to be realistic.
5	deleted	1	This plot caused higher than expected growth yield at older aged stands.
Total		*9*	

6.4 COMPOSITE YIELD CURVES

DMI developed composite yield curves for both the east and west side FMA's. The composite yield curves developed by DMI are best described in the following steps:

Step-1. sum the total net landbase area (ha) for each pathway;
Step-2. join each total pathway area to the growth and yield tables;
Step-3. average coniferous and deciduous yield (m^3/ha) by broad cover group and 10-year age class, weighted by the total pathway area.

Broad cover groups were defined as follows:

D - greater than or equal to 80% of the total crown closure is comprised of deciduous tree species;

DC -greater than 50% of the total crown closure is comprised of the deciduous tree species and greater than 20% is comprised of coniferous tree species;

CD -greater than or equal to 50% of the total crown closure is comprised of the coniferous tree species and greater than 20% is comprised of deciduous tree species;

C - greater than or equal to 80% of the total crown closure is comprised of coniferous tree species.

Because DMI's Growth & Yield stratification regime accounts for succession in several of its pathways, broad cover groups had to be assigned statically to succession based pathways 2 to 6 to ensure smoother composite curves (Table 27). The decision as to "which" broad cover group to assign was based on the perceived dominate harvest period within respective seral stages.

Table 27. Static broad cover group assignment for each succession based pathway in order to estimate composite yield curves.

(1) PATHWAY	(2) CURRENT COVERSTATE TRAJECTORY*	(3) ASSIGNED BCT	(4) AGE CLASS OF ASSIGNED BCT
2	Du3-Du2-Du1-DC	D	70-109
3	Du2-Du1-DC-CD	DC	110-149
4	Du1-DC-CD-Dd	DC	70-109
5	DC-CD-Cd-Cp	CD	70-109
6	Cd-Cp-Cp-Cp	C	All age classes

*Generalized

6.4.1 Results

Five composite curves were produced for both the East and West-side FMA's and are presented in Figure 12 and Figure 13 respectively.

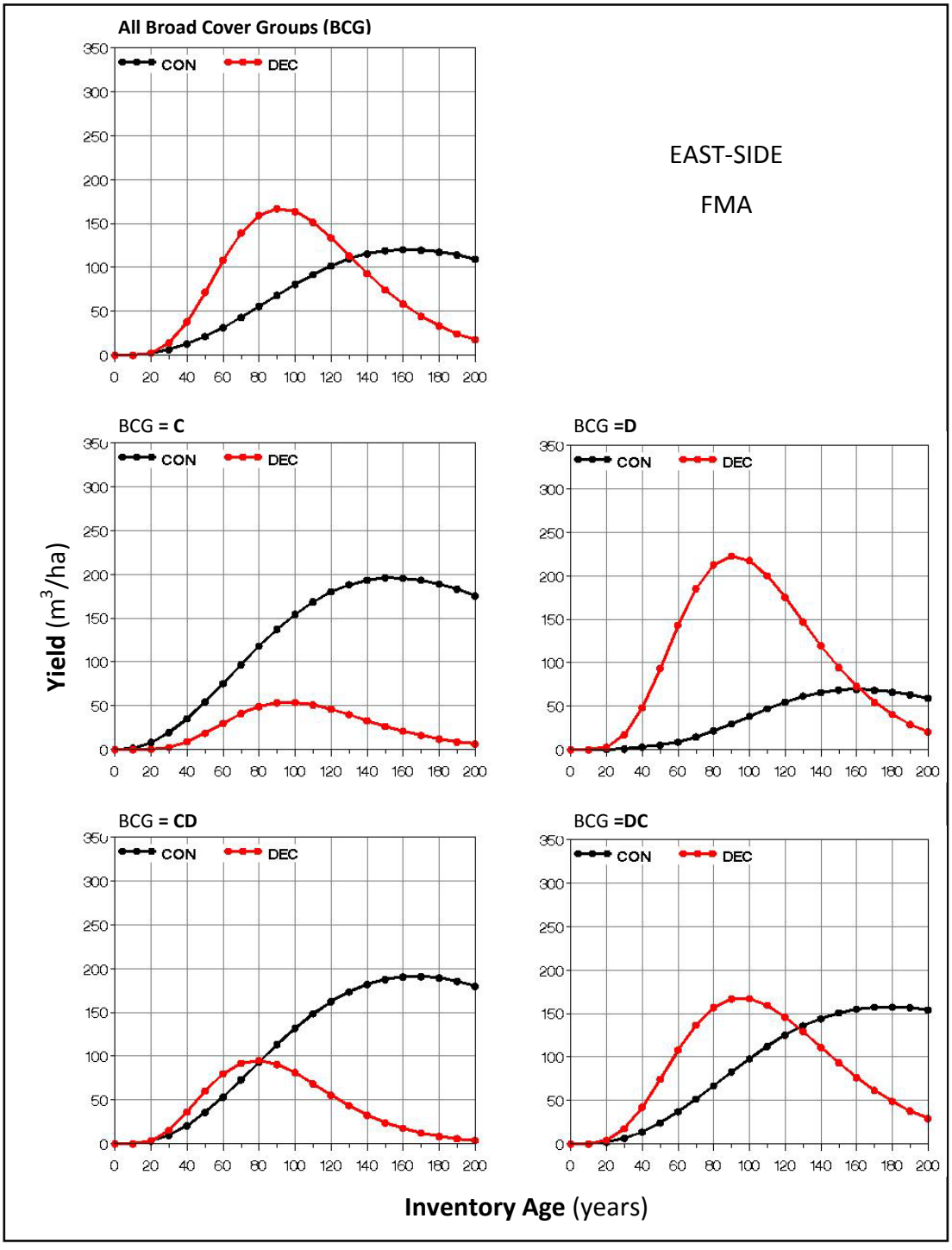


Figure 12. East-side FMA composite yield curves.

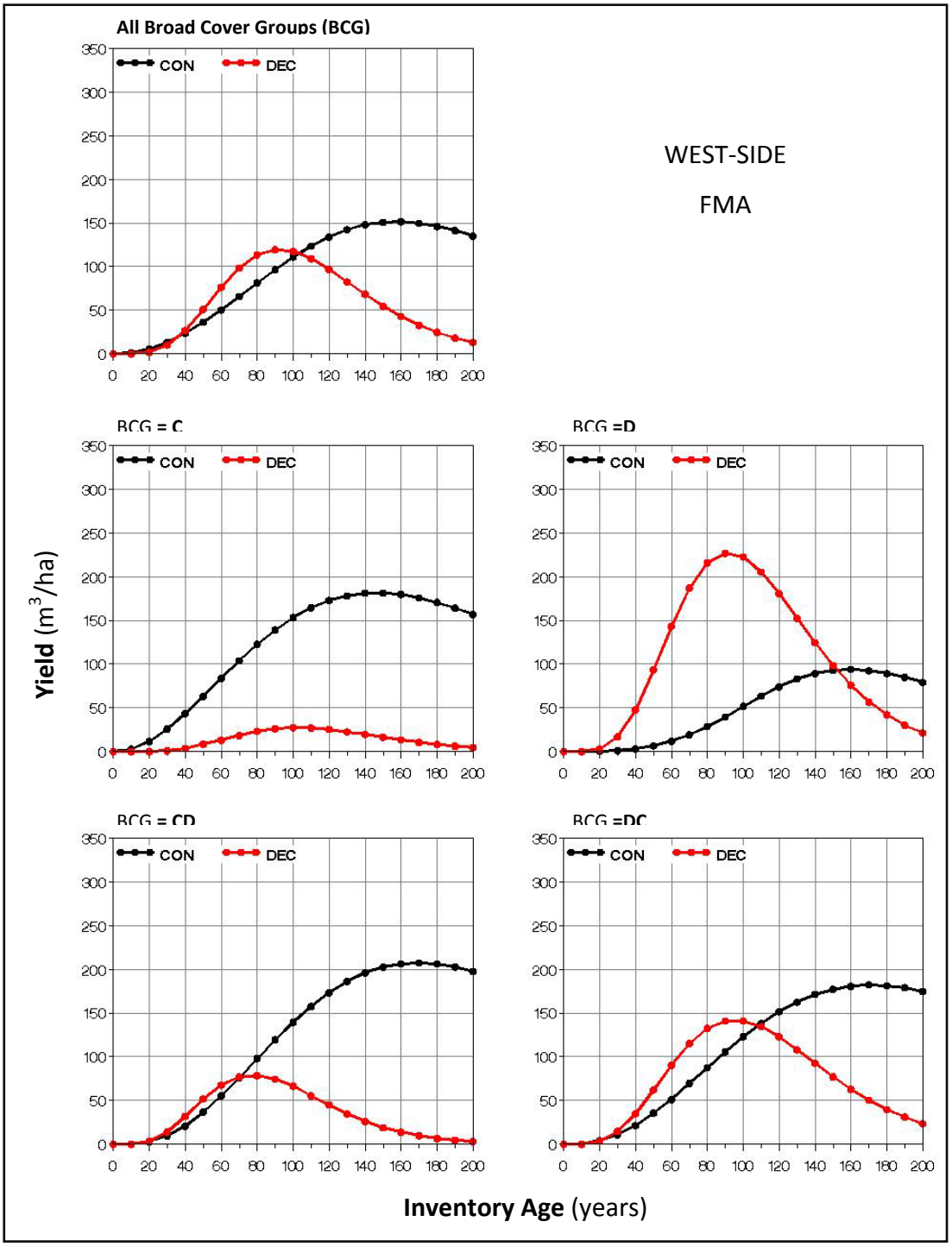


Figure 13. West-side FMA composite yield curves.

7.0 PIECE SIZE MODELING

Merchantable piece size (trees per cubic metre) was modeled using least square linear regression. Input data included the same data used for the growth and yield modeling.

7.1 METHOD

Piece size was calculated for each individual tree using the following equation:

[7] $$p_i = 1/v_i$$

Where: p = *piece size (trees/m^3)*
v = *merchantable volume (m^3)*
i = *i^{th} tree*

Modeling was conducted at the individual tree level and used the indicator variable approach (Bates and Watts, 1998), whereby piece size curves were developed for both coniferous and deciduous tree species independent of pathways. These curves represented a base or 'indicator' model in which individual pathway models were compared to. This required that the entire dataset to be duplicated and appended back to the original dataset, essentially making an exact copy of each plot.

The indicator variable approach was used because it provided more consistent model-fits across pathways. The priority of the sampling design for this project was to model yield and not piece size. Consequently, the landbase stratification was structured so that yield was a function of pathways. In addition, it was theorized that piece size would be less a function of pathways than it would be a function of age anyway.

The indicator variable values used for each pathway are presented in Table 28. Because the entire dataset was aggregated and compared to each pathway the number of indicator variables required equalled the number of pathways.

Table 28. Piece Size Model Indicator variable matrix.
Applies to both coniferous and deciduous models

(1) PATHWAY		(2) INDICATOR VARIABLE											
No.	LABEL	x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11	x12
99	Indicator	0	0	0	0	0	0	0	0	0	0	0	0
1	Aspen >> Shrub	1	0	0	0	0	0	0	0	0	0	0	0
2	Aspen >> White Spruce	0	1	0	0	0	0	0	0	0	0	0	0
3	Aspen >> Late Mixed >> White Spruce	0	0	1	0	0	0	0	0	0	0	0	0
4	Aspen >> Early Mixed >> White Spruce	0	0	0	1	0	0	0	0	0	0	0	0
5	Mixedwood >> White Spruce	0	0	0	0	1	0	0	0	0	0	0	0
6	White Spruce >>White Spruce	0	0	0	0	0	1	0	0	0	0	0	0
7	Pine	0	0	0	0	0	0	1	0	0	0	0	0
8	Pine-Black Spruce-Deciduous	0	0	0	0	0	0	0	1	0	0	0	0
9	Deciduous-Pine-Black Spruce	0	0	0	0	0	0	0	0	1	0	0	0
10	Pine-White Spruce	0	0	0	0	0	0	0	0	0	1	0	0
11	Balsam Poplar >> Shrub	0	0	0	0	0	0	0	0	0	0	1	0
12	Black Spruce-Pine/ White Spruce	0	0	0	0	0	0	0	0	0	0	0	1

The model used to predict piece-size was an inverse logarithmic function. Considering the indicator variable model, the model could be expressed using the following equation:

[8] $$p = \left(a + (y1 \cdot x1) + (y2 \cdot x2) + \cdots + (y11 \cdot x11) + (y12 \cdot x12)\right) \cdot \log(y) + b$$

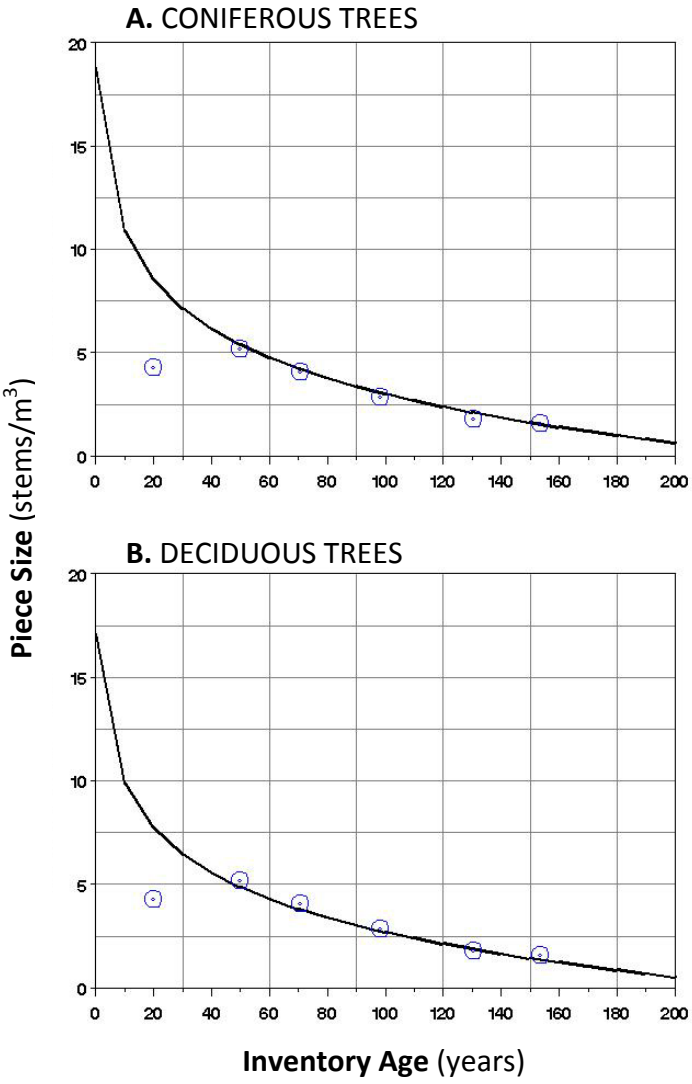
Where: p = Piece size (stems/m^3)
a, b, y1 to y12 = model parameters to be estimated
x1 to x12 = Indicator variables

Weighting

All individual trees were weighted by their respective merchantable volume.

7.2 RESULTS

Results of the indicator model, including a synoptic model test statistic summary, are provided in Figure 14. The pathway independent indicator model was used as the indicator for the pathway dependent coniferous model (Figure 15) and deciduous model (Figure 16).



Model Statistics

RMSE	R^2 *	F VALUE	P VALUE
1.84	0.1201	149	.0000

*Corrected

Model Statistics

RMSE	R^2 *	F VALUE	P VALUE
1.53	0.1266	165	.0000

*Corrected

Figure 14. Coniferous (Graph A) and deciduous (Graph B) indicator models for Piece Size, including associated model test statistics.
Blue dots represent 30-year age class averages.

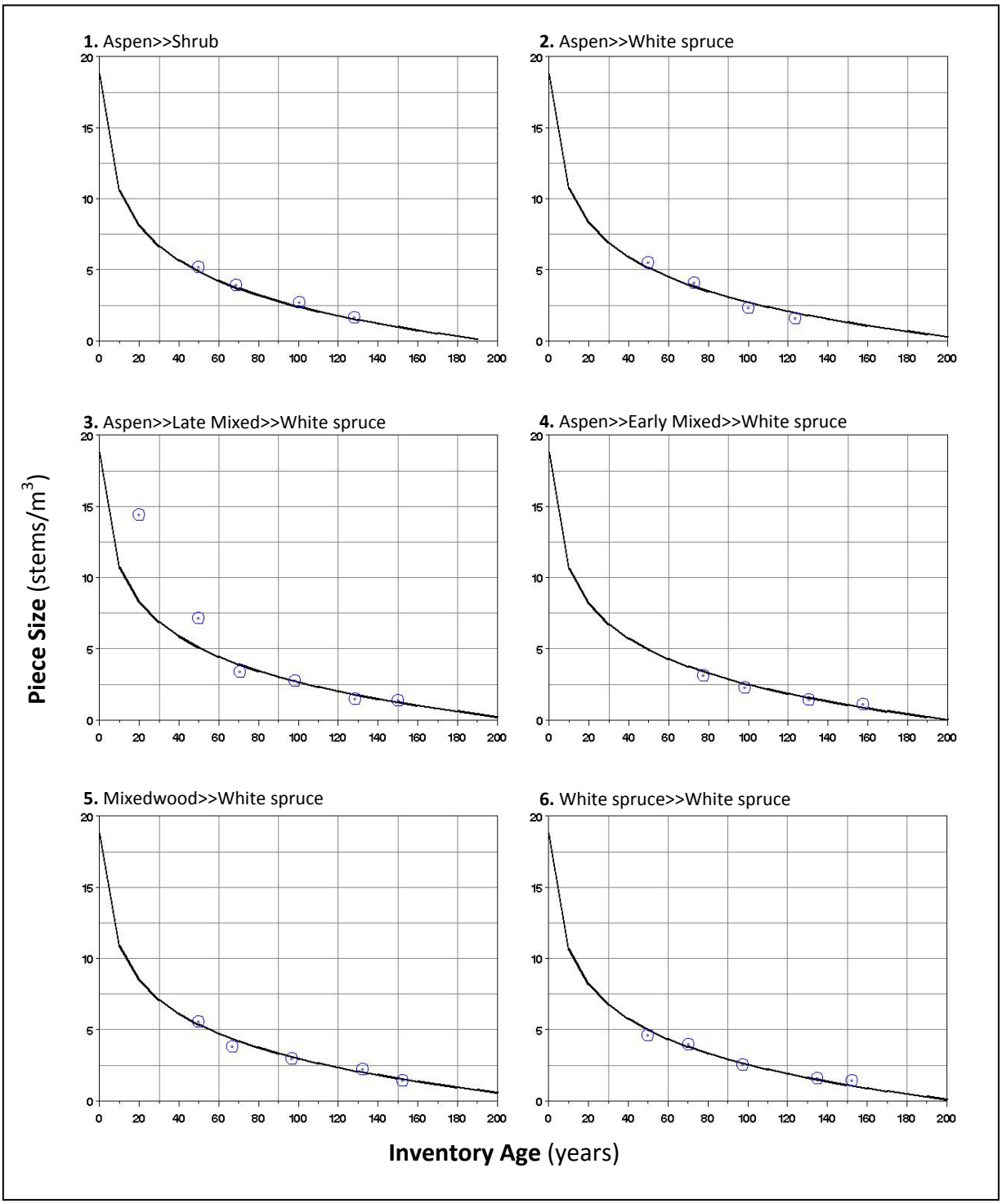
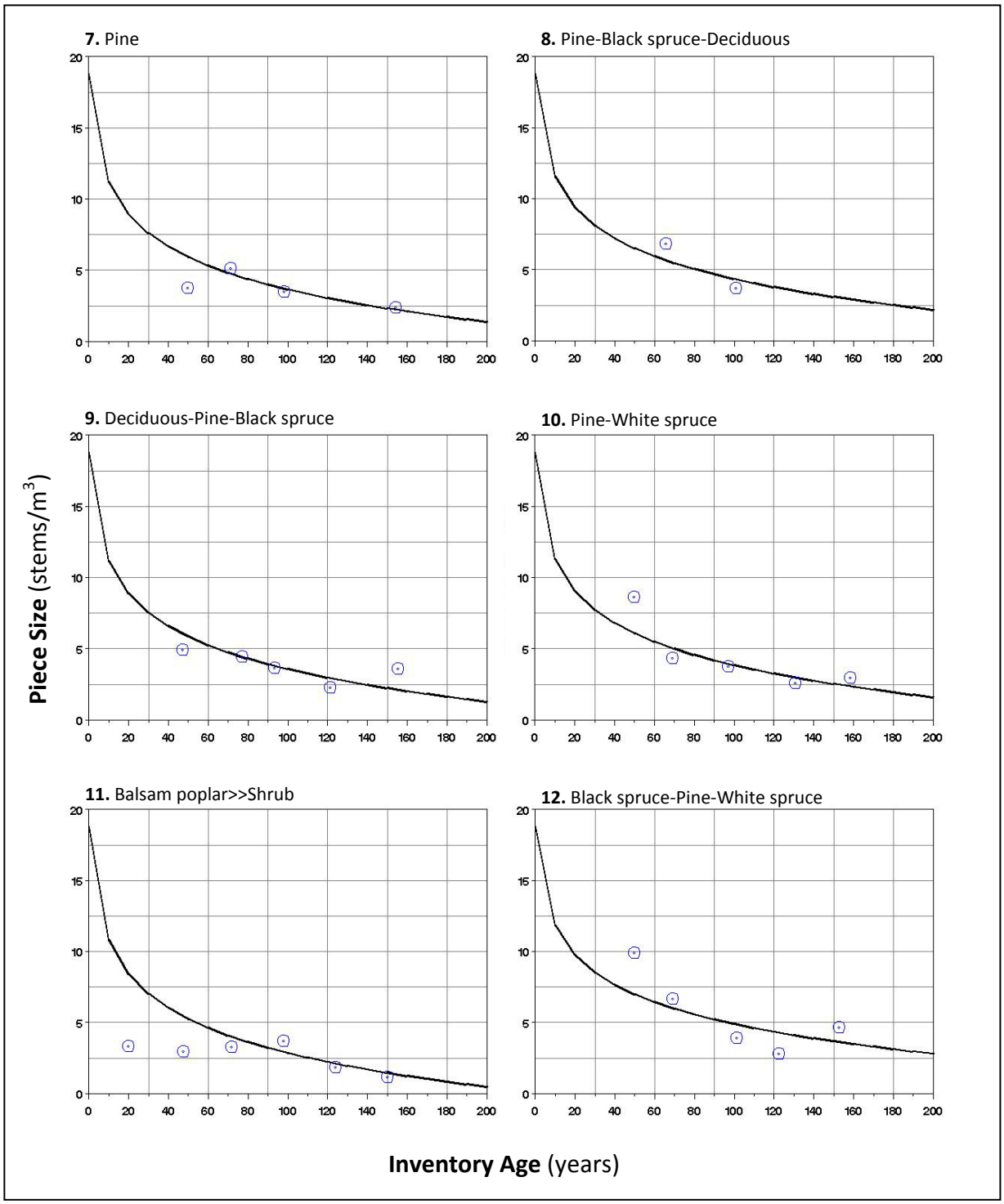


Figure 15. Coniferous Piece Size curves by Pathway

Blue dots represent 30-year age class averages.



Coniferous Piece Size curves by Pathway, Cont'd

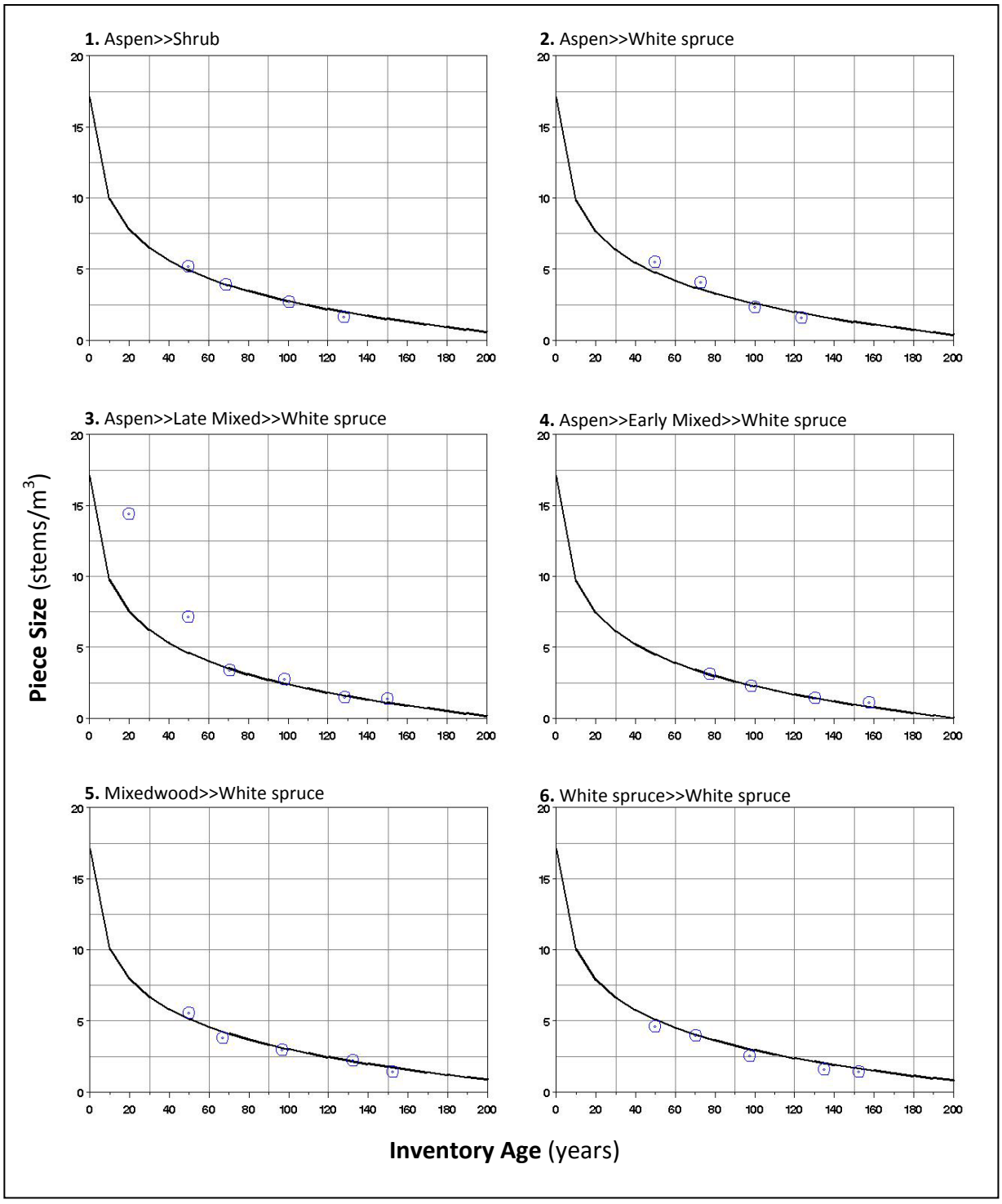
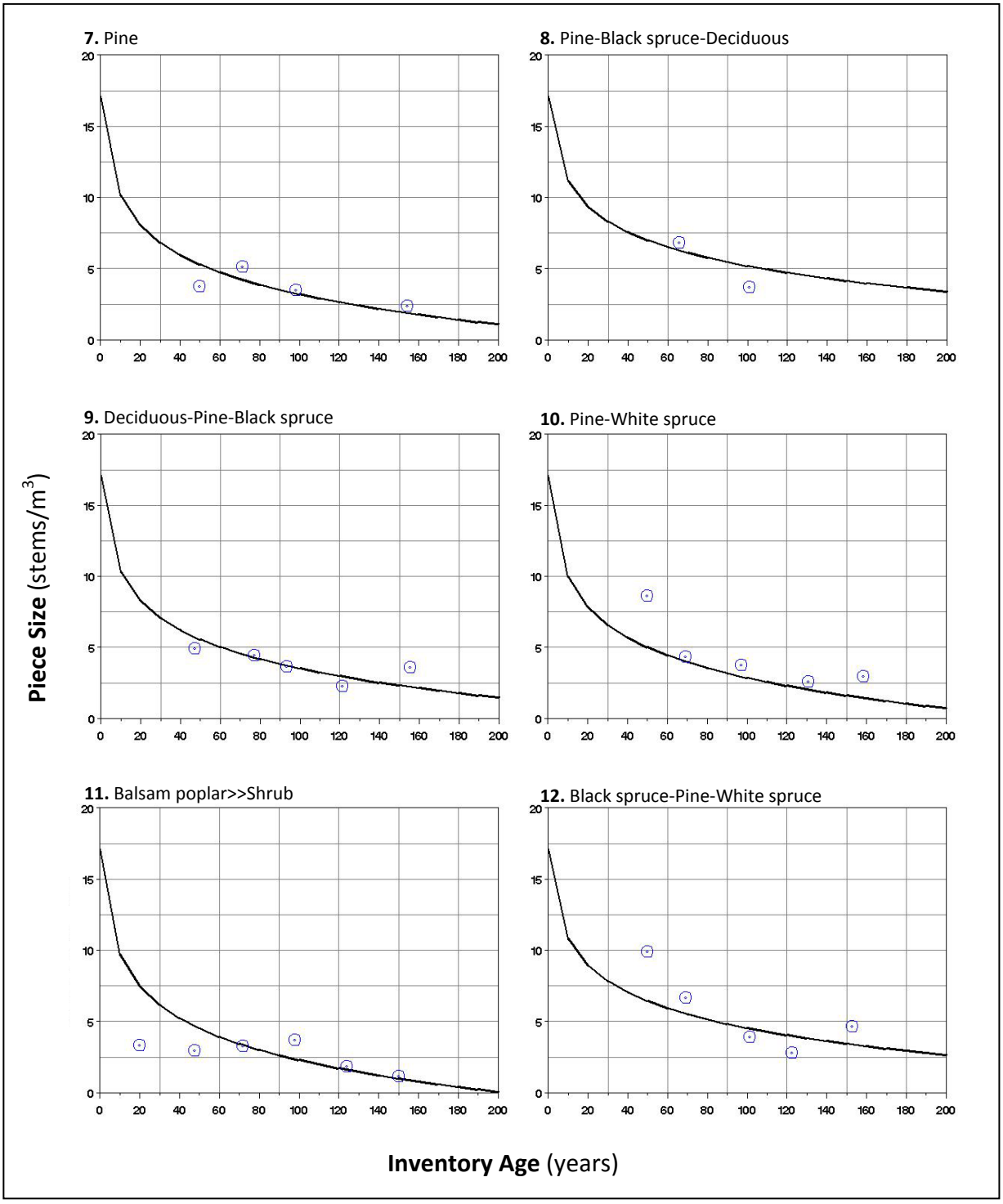


Figure 16. Deciduous Piece Size curves by Pathway

Blue dots represent 30-year age class averages.



Deciduous Piece Size curves by Pathway, Cont'd

7.2.1 Plot Modifications

No plot modifications were made.

7.2.2 Model Modifications

Piece size regression curves that dropped below zero were adjusted to 0.1 stems/m^3. This affected only one model: the coniferous piece size curve of Pathway-1.

8.0 PROPORTION OF MERCHANTABLE VOLUME BY PIECE SIZE CLASS

A second piece size model was developed. Here the proportion of merchantable volume by piece size class was estimated using least-square regression. Like the piece size model (Described in Section7.0 above) this model was based on the indicator variable approach (Bates and Watts, 1998). Unlike the piece size model, which used individual-tree piece sizes as the dependant variable, this model was done at the plot level. The calculation could be best presented by the steps described in Section 8.1 below.

8.1 CALCULATION

Step-1: piece size was calculated for each individual tree using Equation [7], above:

Step-2: individual trees were assigned to one of three classes based on piece-size ranges summarized in Table 29.

Table 29. Piece size classes used for modeling the proportion of merchantable volume by piece size class.

(1) PIECE SIZE CLASS	(2) PIECE SIZE VALUES ($TREES/M^3$)
1	> 0 to <2.5
2	>=2.5 to < 5.0
3	>=5.0

Step-3: each merchantable tree was assigned to either a deciduous or coniferous tree group, based on the same aggregates used in the growth and yield modeling (See Section 6.2 above).

Step-4: for each tree-group in each plot the amount of merchantable volume (m^3) in each piece size class was determined. The procedure could be expressed through the following equation:

[9] $$tv_{gkj} = (\sum_{i=1}^{n} \mathrm{v})_{gkj}$$

Where:
- *tv = total merchantable volume (m^3)*
- *v = merchantable volume (m^3)*
- *g = tree group (coniferous or deciduous)*
- *i = i^{th} tree*
- *j = j^{th} plot*
- *k = k^{th} piece size class 1, 2 & 3*
- *n = the number of trees in each tree group x piece size class x plot*

Step-5: for each tree-group in each plot, the proportion of merchantable volume in each piece size class was then determined using the next equation:

[10] $$r_{gkj} = \left(\mathrm{tv_{gkj}} / \sum_{\mathrm{k=1}}^{3} \mathrm{tv_{gj}}\right) \cdot 100$$

Where:
- *r = proportion of merchantable volume*
- *tv = total merchantable volume (m^3)*
- *g = tree group (coniferous or deciduous)*
- *j = j^{th} plot*
- *k = k^{th} piece size class 1, 2 & 3*

8.2 MODELING

Modeling was conducted on two variables, labelled 'Contact-1' and 'Contact-2', were defined as follows:

Contact-1 = the proportion of merchantable volume in piece-size class-1;

Contact-2 = the proportion of merchantable volume in piece size class-1 + piece size class-2.

Thus, Contact-1 represented the junction, or meeting point, of Piece Size Classes 1 & 2 and Contact-2 represented the meeting point of Piece Size Classes 2 & 3.

Modeling the two meeting points of the three proportions instead of the three piece size classes separately ensured that the ratios were fixed to 1 (or the proportions fixed to 100%) at the modeling stage and thus eliminated the need to conduct subjective 'back-end' model adjustments, which potentially could lead to unnecessary bias.

Although the 'contact' curves could exceed 100% past the range of data, a simple model adjustment to 100 was all that was needed, which was done consistently across all pathways and reflected reality.

Like the piece size modeling described in the previous section (See Section 7.1), and for the same reason, modeling was conducted using the indicator variable approach (Bates and Watts, 1998), whereby the two variables, above, where modeled for coniferous and deciduous tree species independent of pathways.

Indicator values for each pathway are provided in Table 30.

Table 30. Piece Size Proportion Model Indicator variable matrix.

(1) PATHWAY		(2) INDICATOR VARIABLE											
NO.	LABEL	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12
99	Indicator	0	0	0	0	0	0	0	0	0	0	0	0
1	Aspen >> Shrub	1	0	0	0	0	0	0	0	0	0	0	0
2	Aspen >> White Spruce	0	1	0	0	0	0	0	0	0	0	0	0
3	Aspen >> Late Mixed >> White Spruce	0	0	1	0	0	0	0	0	0	0	0	0
4	Aspen >> Early Mixed >> White Spruce	0	0	0	1	0	0	0	0	0	0	0	0
5	Mixedwood >> White Spruce	0	0	0	0	1	0	0	0	0	0	0	0
6	White Spruce >>White Spruce	0	0	0	0	0	1	0	0	0	0	0	0
7	Pine	0	0	0	0	0	0	1	0	0	0	0	0
8	Pine-Black Spruce-Deciduous	0	0	0	0	0	0	0	1	0	0	0	0
9	Deciduous-Pine-Black Spruce	0	0	0	0	0	0	0	0	1	0	0	0
10	Pine-White Spruce	0	0	0	0	0	0	0	0	0	1	0	0
11	Balsam Poplar >> Shrub	0	0	0	0	0	0	0	0	0	0	1	0
12	Black Spruce-Pine/ White Spruce	0	0	0	0	0	0	0	0	0	0	0	1

8.2.1 Equation

Both Contact-1 and Contact-2 were modeled using the same equation used for piece-size; namely, Equation [7], above.

Weighting

For two Pathways plot weighting was required at certain age classes to control for unrealistic model fits. Weighting was done during the least-square regression and is summarized in Table 31.

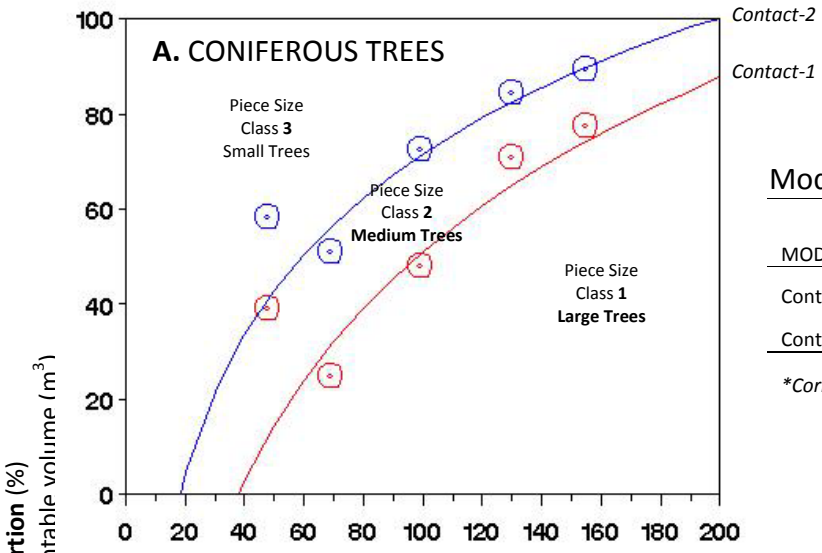
Table 31. Weights used for Piece Size models.

(1) PATHWAY	(2) TREE AGGREGATE	(3) AGE CLASS	(4) WEIGHT
11	Conifer	>= 120 years	10
8	Deciduous	>= 90 years	10

8.3 RESULTS

Results of the indicator model, including a synoptic model test statistic summary, are provided in Figure 17. The area below the lower (red) curve represents the proportion of merchantable volume in Piece Size Class 1 (i.e. 0 to 2.5 trees per cubic metre). The area between the lower (red) curve and upper (blue) curve represents the proportion of merchantable volume in Piece Size Class 2 (i.e. 2.5 to 5.0 trees per cubic metre). Finally, the area above the upper (blue) curve represents the proportion of merchantable volume in Piece Size Class 3 (i.e. greater than 5.0 trees per cubic metre).

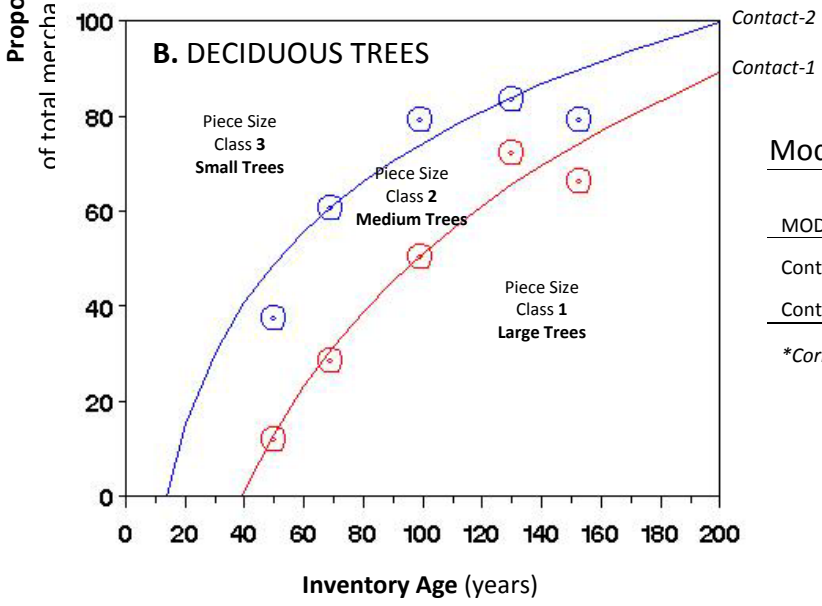
The pathway independent indicator model was used as the indicator for the pathway dependent coniferous model (Figure 18) and deciduous model (Figure 19).



Model Statistics

MODEL	SSE	R^2 *	F VALUE	P VALUE
Contact1	1142471	0.288	32.44	.0000
Contact2	968664	0.227	23.51	.0000

**Corrected*



Model Statistics

MODEL	SSE	R^2 *	F VALUE	P VALUE
Contact1	1135395	0.258	27.06	.0000
Contact2	1020258	0.178	16.78	.0000

**Corrected*

Figure 17. Coniferous (Graph A) and deciduous (Graph B) indicator models for the proportion of merchantable yield in three piece size classes, including associated model test statistics

The bottom Red Curve represents the predicted value of the proportion of merchantable volume in Piece size class-1; the top blue curve represents the predicted value of the proportion of merchantable volume in Piece size Class-1 plus Piece size class-2. Points represent 30 year averages. Individual plot values were not plotted for graphic clarity.

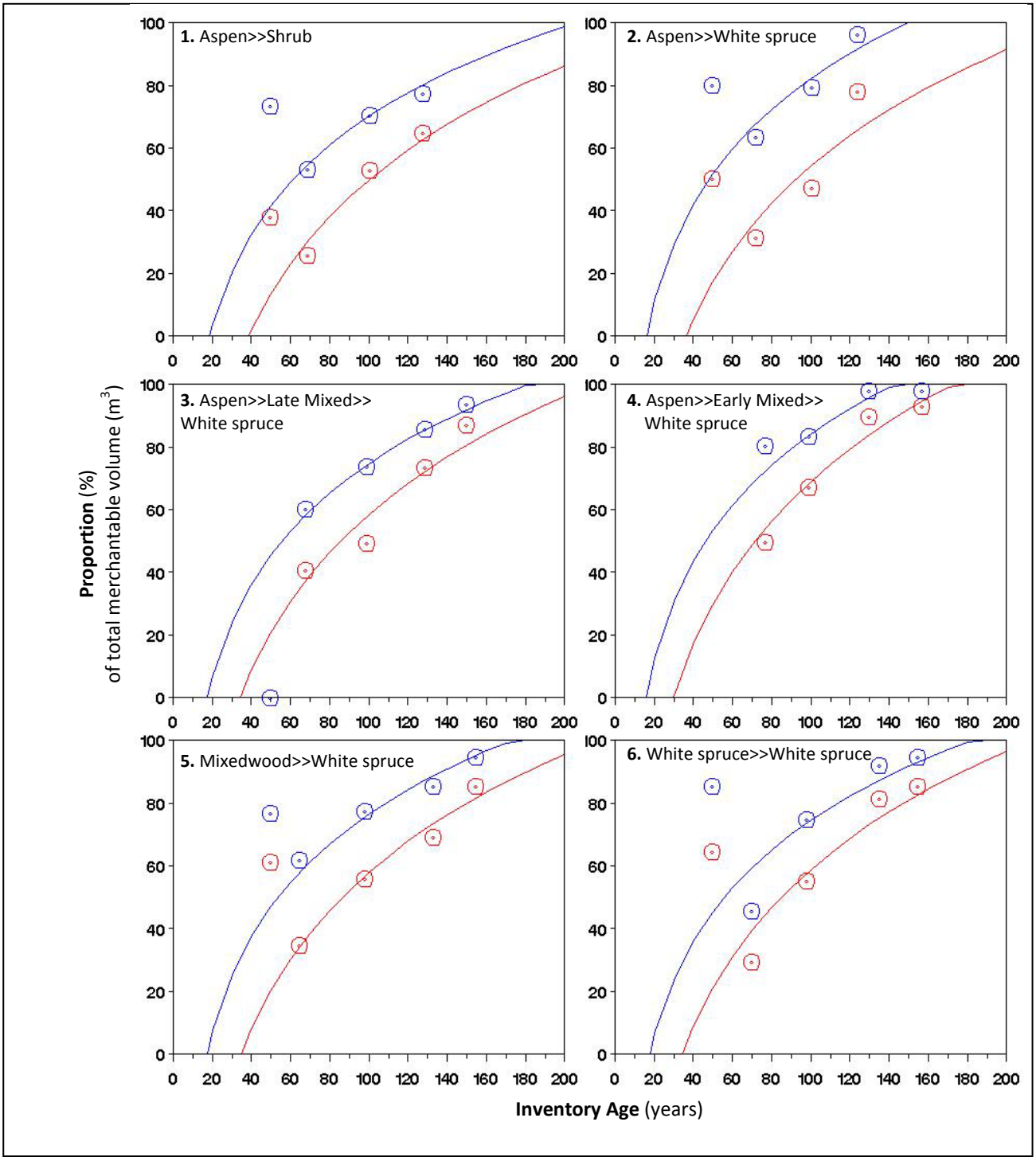


Figure 18. Coniferous Piece Size Proportion curves by Pathway

The bottom Red Curve represents the predicted value of the proportion of merchantable volume in Piece size class-1 (i.e. Contact 1); the top blue curve represents the predicted value of the proportion of merchantable volume in Piece size Class-1 plus Piece size class-2 (i.e. Contact 2). Points represent 30 year averages. Individual plot values were not plotted for clarity.

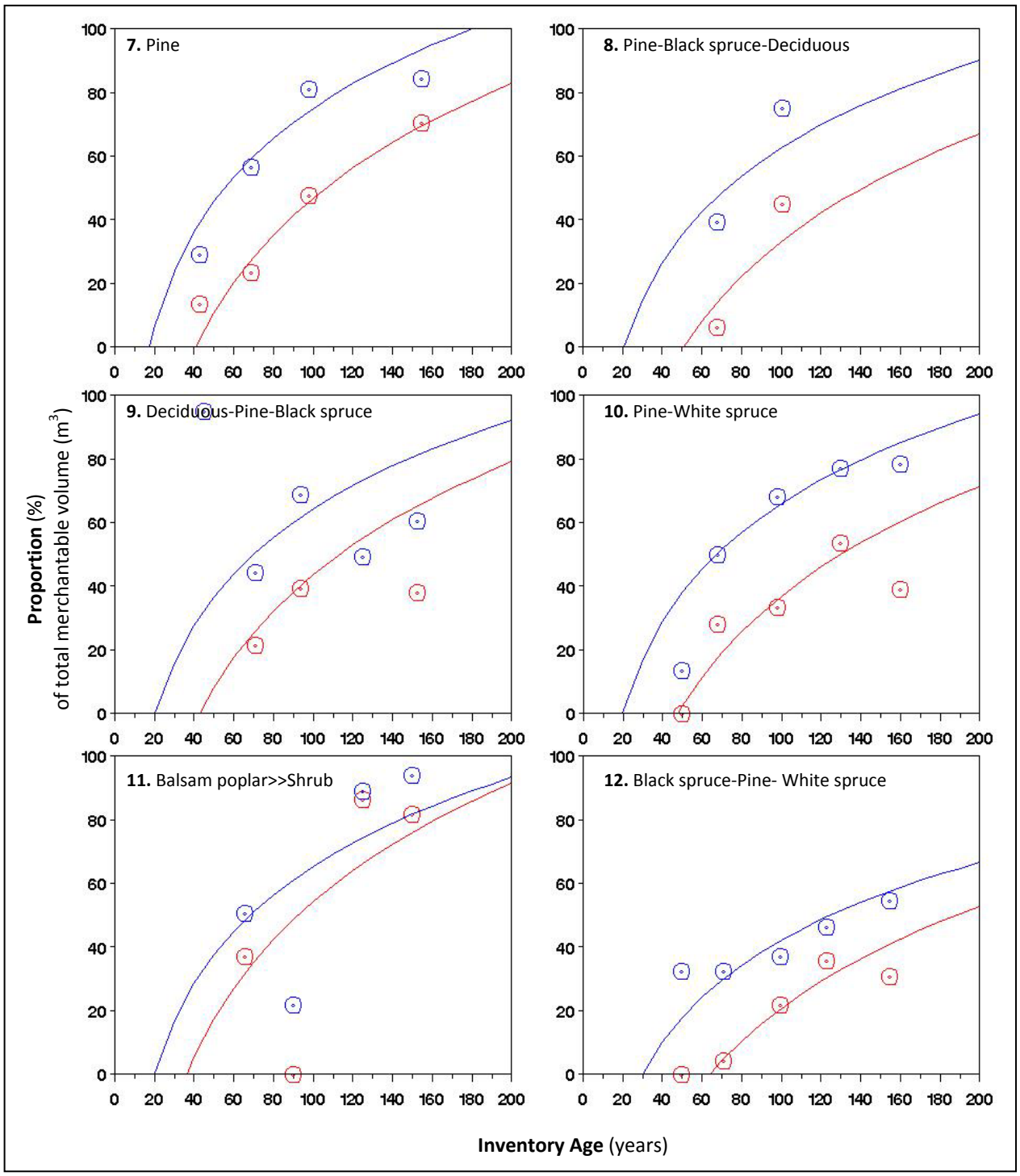


Figure 18 Cont'd

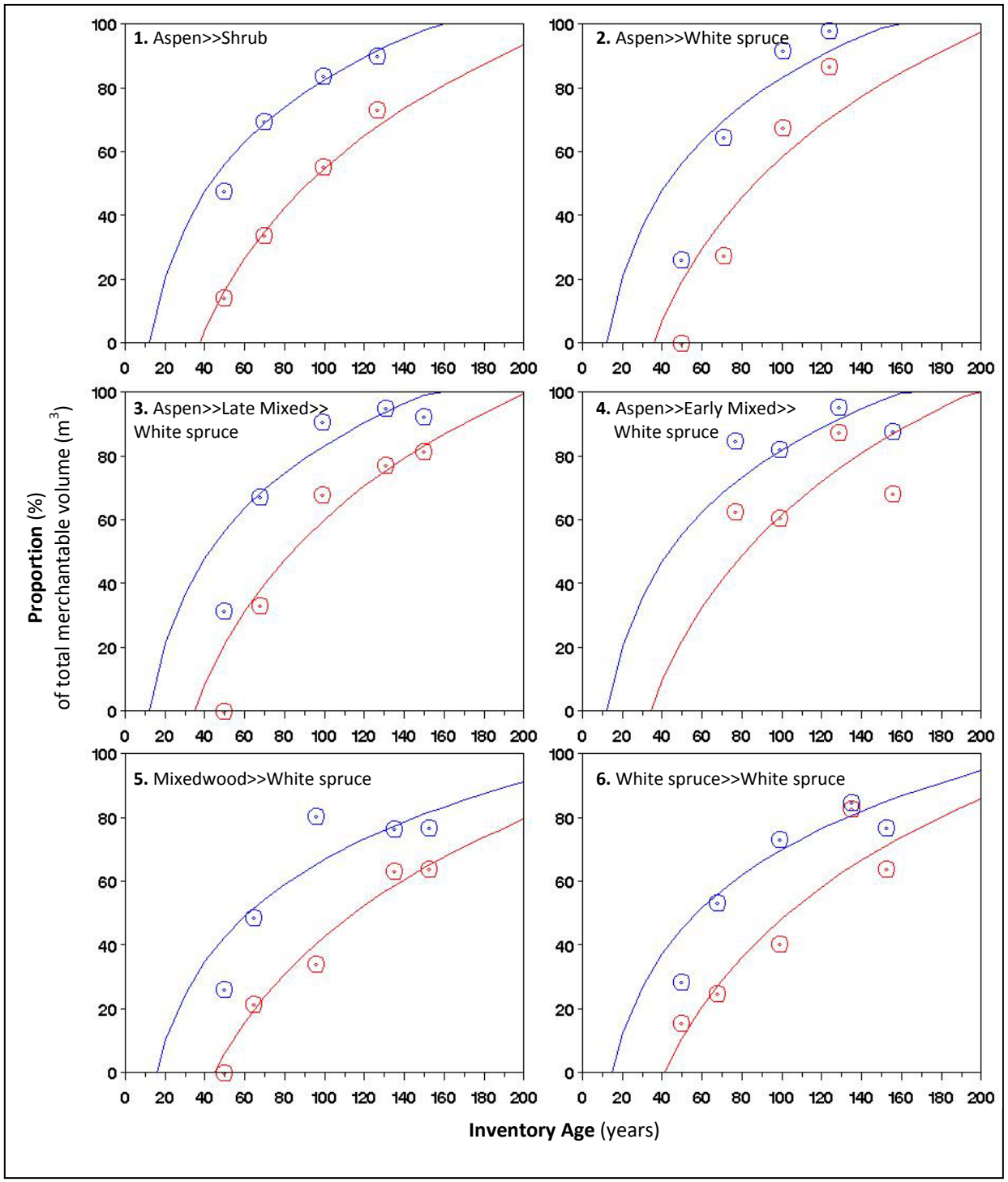


Figure 19. Deciduous Piece Size Proportion curves by Pathway

The bottom Red Curve represents the predicted value of the proportion of merchantable volume in Piece size class-1 (i.e. Contact 1); the top blue curve represents the predicted value of the proportion of merchantable volume in Piece size Class-1 plus Piece size class-2 (i.e. Contact21). Points represent 30 year averages. Individual plot values were not plotted for clarity.

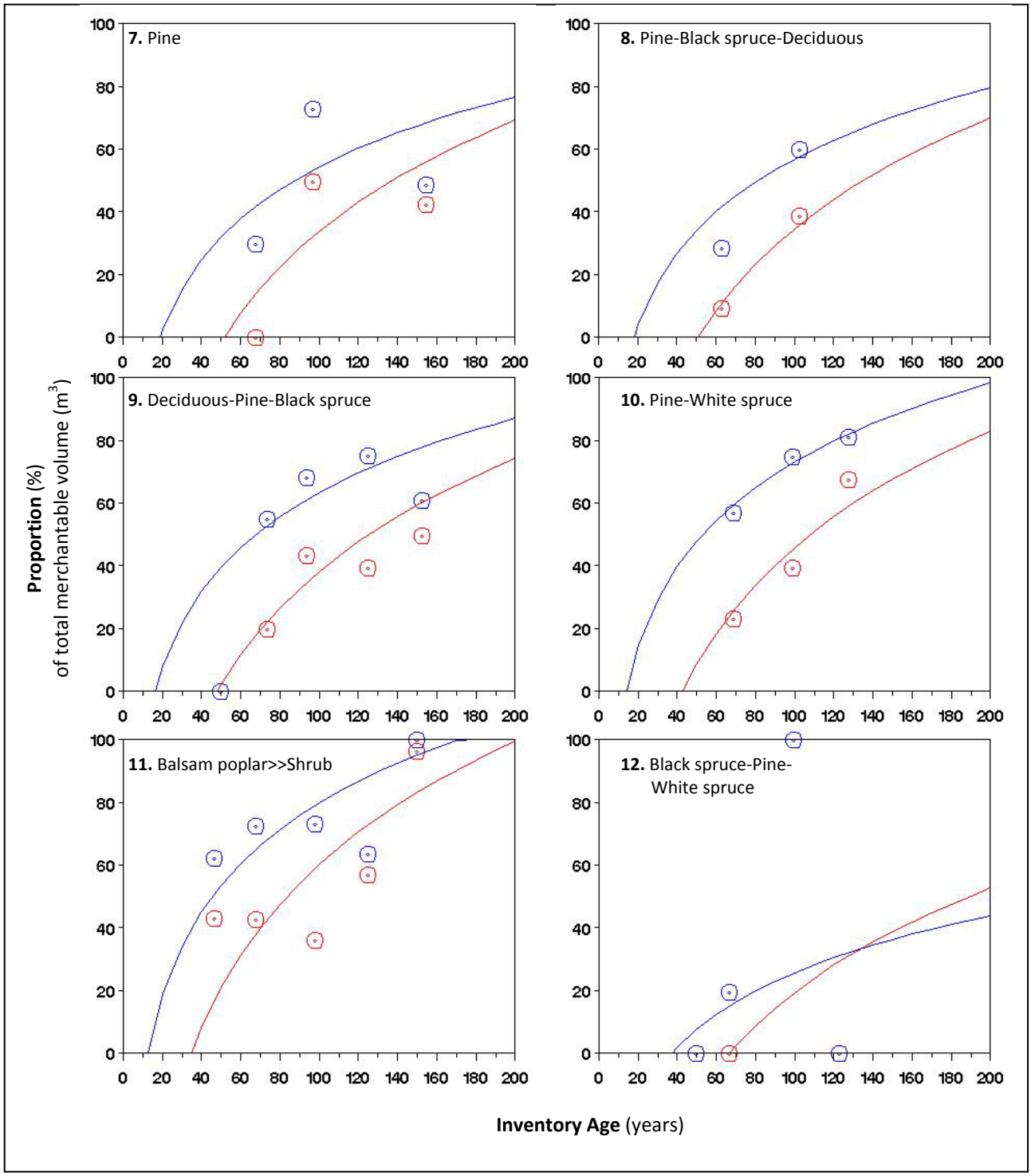


Figure 19 Cont'd

Plot Modifications

Unlike the yield modeling, which required several modifications to the plots, almost all the plot data was used for piece size modeling. This was except for plots located in Pathway 2 in stands greater than or equal to 150 years of age, which were removed from the analysis outright. These plots were removed because it was felt, subjectively, that better fits to the data occurred without them.

Model Modifications

The deciduous piece size model for Pathway 12 (See Figure 19) was unrealistic. This was mainly caused by the lack of deciduous component in the sample, as was the case with the deciduous yield model of the same Pathway. The few plots that did have deciduous volume were classified as Piece Size Class 1; there were no classes 2 or 3. To correct this, the Conifer Piece Size curve for Pathway 12 was used as a surrogate for the deciduous model.

9.0 FACTSHEETS

Information summaries are provided for each pathway using the fact sheet format. For this format all descriptions, tables and figures use abbreviated label descriptions, no numbering and are often not referenced in any text provided.

9.1 HOW TO READ FACTSHEETS

Seven types of information are provided for each pathway. They are as follows:

1. AVI Criteria
2. Current Landbase State
3. Base Yield Models
4. Regionalized Composite Yield Models
5. Compare East & West Side Models
6. Stand Trajectory
7. East and West side Yield Tables

Each type is described in more detail below.

1. AVI Criteria

The criteria that defined each pathway are written.

2. Current Landbase State

The current landbase state is described using a bubble graph (left y-axis) superimposed with a histogram (right y-axis) over 10-year stand age classes from 10 years to 200 years (x-axis).

The bubble graph shows the area weighted mean of individual tree species cover (in percent) for both the overstory and understory. The higher the mean percent cover the larger the bubble and several bubbles are labelled with the actual mean value rounded off to the nearest 1 percent to provide a quantitative reference. The tree species codes on the left y-axis are as follows:

AW: Trembling aspen;

PB: Balsam poplar;

BW: White (paper) birch;

LT: Larch (tamarack);

PX: Pine species (either Lodgepole pine or Jack pine);

SB: Black spruce;

SW: White spruce;

FB: Balsam fir.

Understory tree species are defined using the same labels but in lower case.

The histogram (represented using a line graph) shows the amount of area (in hectares) that occurs in each 10-year stand age class.

3. Base Yield Models

Base Yield models are presented using two graphs; one for deciduous yield and one for coniferous yield. The x-axis represents 10-year stand age class from 0 to 200 years. The y-axis represented the merchantable yield (m^3/ha) from 0 to 500. The black line represents the modelled average yield using non-linear least-square modeling techniques. Red dots represent respective plot-level yield while black dots represents 20 year average yield.

The two graphs were generated using all the plot data across the two FMA's and are exact copies of the graphs presented in the previous Growth & Yield modeling section of this document.

4. Regionalized Composite Yield Models

Regionalized, composite yield models are represented by two graphs: one for the East-side FMA and one for the West-side FMA. The x-axis represents 10-year stand age class from 0 to 200 years. The y-axis represents the merchantable yield (m^3/ha) from 0 to 350. Both graphs show the modelled average yield for deciduous and coniferous tree species as well as the total combined tree species. The total combined yield curve was the result of adding the average deciduous and coniferous yield together.

5. Compare East & West Side Models

Respective regionalized deciduous and coniferous growth and yield models are presented by two graphs in order to provide a direct comparison of the regionalized models. The x-axis represents 10-year stand age class from 0 to 200 years. The y-axis represents the merchantable yield (m^3/ha) from 0 to 500. Both graphs compare the modelled average yield for the West-side FMA (dashed red line), the East-side FMA (solid blue line) and for the base model (dashed black line and labelled "ALL"). Each line is an exact copy of those presented in the previous two sets of graphs (3 & 4).

6. Stand Trajectory

The trajectory of each pathway is depicted using a table matrix of seral stage and coverstate.

Seral stages are four broad age class groupings which form one of the criteria that define pathways. The groupings are as follows:

0-69: Stand ages greater than 0 and less than 70 years;

70-109: Stand ages greater than 69 and less than 110 years;

110-149: Stand ages greater than 109 and less than 150 years;

150+: Stand ages greater than 149 years.

Coverstates are 9 stand type groupings which also form one of the criteria that define pathways. The groupings are as follows:

D: Deciduous dominant overstorey (>=80%) with no spruce or fir in the understory;

Du1: Deciduous dominant overstorey (>=80%) with spruce or fir in the understorey having an AVI height between 3 to 6 meters less than the overstory AVI height;

Du2: Deciduous dominant overstorey (>=80%) with spruce or fir in the understorey having an AVI height between 6 to 9 meters less than the overstory AVI height;

Du3: Deciduous dominant overstorey (>=80%) with spruce or fir in the understorey having an AVI height greater than 9 meters less than the overstory AVI height;

DC: Deciduous leading mixedwood (>50% deciduous & >20% coniferous);

CD: Coniferous leading mixedwood (>=50% coniferous & >20% deciduous);

C: Coniferous dominant overstorey (>=80%);

Cd: Coniferous dominant overstorey (80% or 90%);
Cp: Pure coniferous overstorey (100%).

7. East and West side Yield Tables

Yield models, piece size models and landbase information area presented in table format for both the East-side and the West-side FMAs. Other information such as Broad-Cover type and maturity classes' assigned to each growth and yield pathway is also provided. The headers in this table are as follows:

(1) AGE: The 10-year stand age class from 10 years to 200 years.

(2) BCT: The Broad Cover Type, specific to the AVI overstory tree species cover and having the following codes and definitions:

D: Deciduous dominant (>80%);
DC: Deciduous leading mixedwood (>50% deciduous and >20% coniferous);
CD: Coniferous leading mixedwood (>=50% coniferous and >20% deciduous);
C: Coniferous dominant (>80%).

(3) MC: Maturity Class reflects growth, senescence, mortality and self-replication (convergence) stages of both deciduous and coniferous tree species aggregates. Maturity class is tied specifically to stand age using the following codes and definitions:

SI: Stem Initiation. Defined when most of the initial tree recruitment occurs in the stand. In the growth and yield table, SI is fixed to the 10 year stand age class for deciduous yield and both the 10 year and 20 year stand age classes for coniferous yield;
SE: Stem Exclusion. Defined when full site utilization occurs and inter-stem competition causes high mortality. In the growth and yield table, SE is

fixed to the 20 and 30 year stand age classes for deciduous yield and the 30, 40 and 50 stand age classes for coniferous yield ;

I: Immature. Defined when mortality reduces and full crown closure occurs. This stage represents a rapid increase in stand volume. In the growth and yield table, the immature stage is fixed to the 40, 50, 60 and 70 stand age classes for deciduous yield and the 60, 70 and 80 stand age classes for coniferous yield;

M: Mature. Defined when crown closure stabilizes. Although yield is still increasing the relative rate of volume is usually lower than the immature stage. In the growth and yield table, the mature stage is fixed to the 80 and 90 stand age classes for deciduous yield and 90, 100, 110 and 120 stand age classes for coniferous yield;

B: Breakup. Defined where crown closure is reduced because of senescence and mortality. In the growth and yield table, breakup is fixed to stand age classes 100 years and older for deciduous; and 130 years and older for coniferous.

(4) YIELD: Yield models (m^3/ha) for deciduous, coniferous and total tree species aggregates.

(5) MAI: Mean Annual Increment (m^3/ha/year) calculated by dividing yield by associated stand age class for deciduous, coniferous and total tree species aggregates, respectively.

(6) PIECE SIZE [curves]: Piece size curves (stems/m^3) for both deciduous and coniferous tree species aggregates.

(7) PIECE SIZE [proportion]: Piece size models tied to the percentage of total merchantable volume (m^3) for both deciduous and coniferous tree species aggregates. Piece size classes are as follows:

L: Large trees. > 0 to < 2.5 trees per cubic metre;

M: Medium Trees. >=2.5 to <5.0 trees per cubic metre;

S: Small Trees. >=5.0 trees per cubic metre.

(8) LAND-BASE AREA: The total area (ha) that was inventoried on the landbase for each 10-year stand age class.

(9) STANDING MERCH. CROP. The total deciduous and coniferous Standing Merchantable Crop (m^3) calculated by multiplying yield by associated area for each 10-year stand age class.

9.2 FACTSHEETS

PATHWAY 1: ASPEN >> SHRUB

1. AVI Criteria

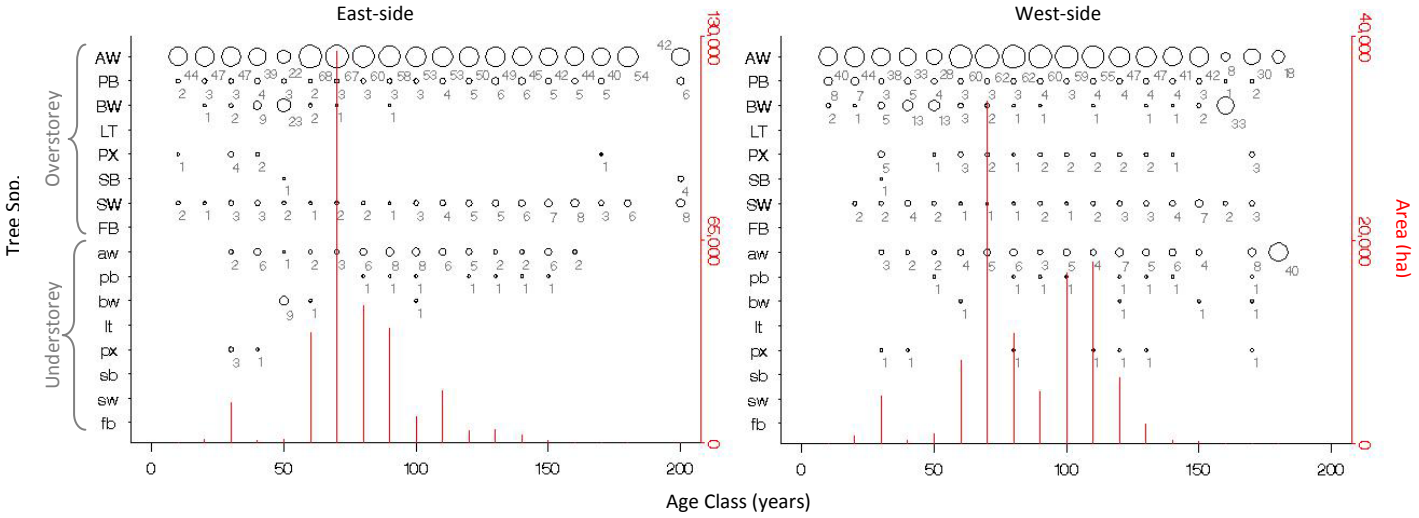
Pathway 1 is a succession based pathway where pine species, black spruce and/or Larch are: 1) less than or equal to 20% of the overstory tree species composition and; 2) less than or equal to 40% of the understorey tree species composition. Pathway 1 is separated from the other succession based pathways in that it is deciduous dominant (i.e. the coverstate remains 'D' across stand age) and balsam poplar is not the leading tree species. Although rare, white birch can be the dominant tree species with or without aspen. Being in the 'D' coverstate category, conifer tree species are never greater than 20% of the overstorey composition and no white spruce, black spruce or fir tree species occurs in the understorey.

Succession

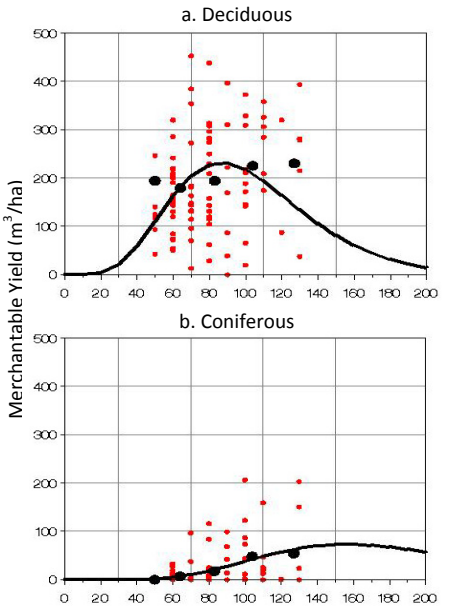
In the absence of catastrophic disturbances most stands will succeed to shrub or open deciduous and shrub by about 200 years.

Note: Refer to Section 9.1 above for graph/table details

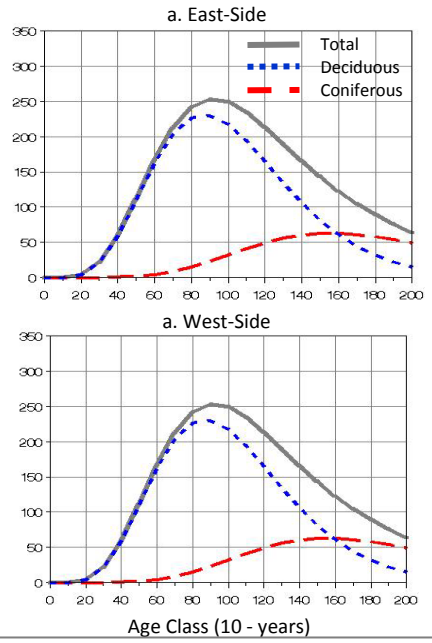
2. Current Landbase State



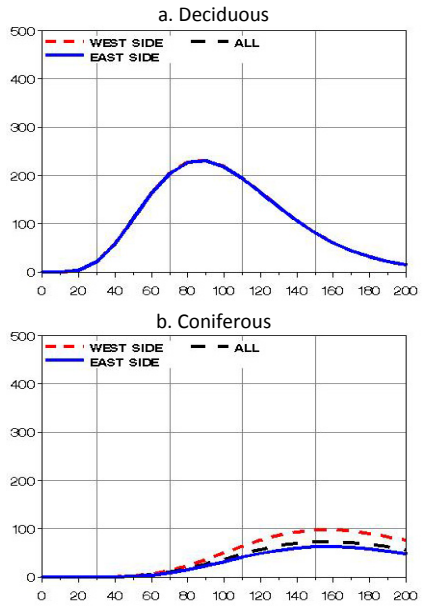
3. Base Yield Models



4. Regionalized Composite Yield



5. Compare East & West Side Models



PATHWAY 1: ASPEN >> SHRUB Cont'd

6. Stand Trajectory

SERAL STAGE (YRS.)	0 -69	70 -109	110-149	150+
COVER-STATE	D	D	D	D-Shrub

7a. East Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m³/ha)			(5) MAI (m³/ha/yr)			(6) PIECE SIZE (stems/m³)		(7) PIECE SIZE % of merch. vol. (m³) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m³)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	D			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	D	SI	SI	0	0	0	0.00	0.00	0.00	9.93	10.58	0	0	100	0	0	100	7,751	0	0
20	D	SE	SI	4	0	4	0.20	0.00	0.20	7.77	8.12	0	21	79	0	4	96	11,285	45,140	0
30	D	SE	SE	22	0	22	0.73	0.00	0.73	6.51	6.68	0	36	64	0	20	80	22,156	487,432	0
40	D	I	SE	59	1	60	1.48	0.03	1.50	5.62	5.66	4	44	52	2	31	67	2,927	172,693	2,927
50	D	I	SE	110	2	112	2.20	0.04	2.24	4.92	4.87	16	40	44	13	28	59	3,187	350,570	6,374
60	D	I	I	163	4	167	2.72	0.07	2.78	4.36	4.22	26	37	37	23	26	51	45,942	7,488,546	183,768
70	D	I	I	204	9	213	2.91	0.13	3.04	3.88	3.67	35	34	31	31	24	45	149,351	30,467,604	1,344,159
80	D	MAT	I	227	15	242	2.84	0.19	3.03	3.46	3.20	42	32	26	38	23	39	49,733	11,289,391	745,995
90	D	MAT	MAT	230	23	253	2.56	0.26	2.81	3.10	2.78	49	30	21	44	22	34	43,339	9,967,970	996,797
100	D	B	MAT	218	32	250	2.18	0.32	2.50	2.77	2.41	55	28	17	50	20	30	9,816	2,139,888	314,112
110	D	B	MAT	194	41	235	1.76	0.37	2.14	2.47	2.07	60	26	14	55	19	26	21,670	4,203,980	888,470
120	D	B	MAT	165	49	214	1.38	0.41	1.78	2.20	1.76	65	25	10	59	19	22	4,626	763,290	226,674
130	D	B	B	134	56	190	1.03	0.43	1.46	1.95	1.48	69	23	8	64	17	19	5,474	733,516	306,544
140	D	B	B	106	60	166	0.76	0.43	1.19	1.72	1.21	73	22	5	67	17	16	2,804	297,224	168,240
150	D	B	B	81	63	144	0.54	0.42	0.96	1.51	0.97	77	21	2	71	16	13	930	75,330	58,590
160	D	B	B	61	63	123	0.38	0.39	0.77	1.31	0.74	81	19	0	75	15	10	267	16,287	16,821
170	D	B	B	44	61	105	0.26	0.36	0.62	1.12	0.52	84	16	0	78	14	8	396	17,424	24,156
180	D	B	B	32	58	90	0.18	0.32	0.50	0.94	0.32	87	13	0	80	14	6	5	160	290
190	D	B	B	22	54	76	0.12	0.28	0.40	0.77	0.15	90	10	0	84	13	3	0	0	0
200	D	B	B	15	49	64	0.08	0.25	0.32	0.61	0.15	93	7	0	86	13	1	26	390	1,274

7b. West Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m³/ha)			(5) MAI (m³/ha/yr)			(6) PIECE SIZE (stems/m³)		(7) PIECE SIZE % of merch. vol. (m³) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m³)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	D			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	D	SI	SI	0	0	0	0.00	0.00	0.00	9.93	10.58	0	0	100	0	0	100	4,528	0	0
20	D	SE	SI	4	0	4	0.20	0.00	0.20	7.77	8.12	0	21	79	0	4	96	9,383	37,532	0
30	D	SE	SE	22	0	22	0.73	0.00	0.73	6.51	6.68	0	36	64	0	20	80	11,006	242,132	0
40	D	I	SE	59	1	60	1.48	0.03	1.50	5.62	5.66	4	44	52	2	31	67	2,554	150,686	2,554
50	D	I	SE	111	3	113	2.22	0.06	2.26	4.92	4.87	16	40	44	13	28	59	2,841	315,351	8,523
60	D	I	I	163	7	170	2.72	0.12	2.83	4.36	4.22	26	37	37	23	26	51	14,086	2,296,018	98,602
70	D	I	I	205	14	219	2.93	0.20	3.13	3.88	3.67	35	34	31	31	24	45	44,685	9,160,425	625,590
80	D	MAT	I	228	24	252	2.85	0.30	3.15	3.46	3.20	42	32	26	38	23	39	12,077	2,753,556	289,848
90	D	MAT	MAT	231	36	268	2.57	0.40	2.98	3.10	2.78	49	30	21	44	22	34	7,143	1,650,033	257,148
100	D	B	MAT	219	50	269	2.19	0.50	2.69	2.77	2.41	55	28	17	50	20	30	19,247	4,215,093	962,350
110	D	B	MAT	195	64	259	1.77	0.58	2.35	2.47	2.07	60	26	14	55	19	26	21,400	4,173,000	1,369,600
120	D	B	MAT	166	76	242	1.38	0.63	2.02	2.20	1.76	65	25	10	59	19	22	7,839	1,301,274	595,764
130	D	B	B	135	87	222	1.04	0.67	1.71	1.95	1.48	69	23	8	64	17	19	2,170	292,950	188,790
140	D	B	B	107	94	200	0.76	0.67	1.43	1.72	1.21	73	22	5	67	17	16	388	41,516	36,472
150	D	B	B	82	98	179	0.55	0.65	1.19	1.51	0.97	77	21	2	71	16	13	320	26,240	31,360
160	D	B	B	61	98	159	0.38	0.61	0.99	1.31	0.74	81	19	0	75	15	10	135	8,235	13,230
170	D	B	B	44	95	140	0.26	0.56	0.82	1.12	0.52	84	16	0	78	14	8	45	1,980	4,275
180	D	B	B	32	90	122	0.18	0.50	0.68	0.94	0.32	87	13	0	80	14	6	2	64	180
190	D	B	B	22	84	106	0.12	0.44	0.56	0.77	0.15	90	10	0	84	13	3	0	0	0
200	D	B	B	15	76	91	0.08	0.38	0.46	0.61	0.15	93	7	0	86	13	1	4	60	304

PATHWAY 2: ASPEN >> WHITE SPRUCE

1. AVI Criteria

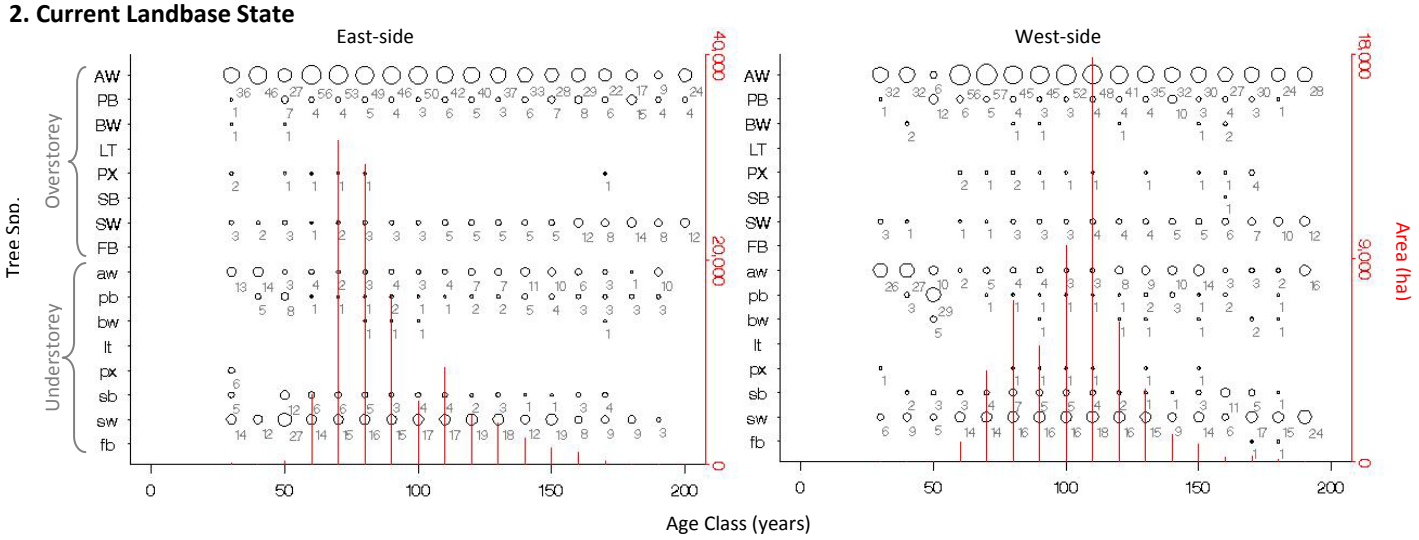
Pathway 2 is a succession based pathway where pine species, black spruce and/or Larch are: 1) less than or equal to 20% of the overstory tree species composition and; 2) less than or equal to 40% of the understorey tree species composition. Pathway 2 is seperated from the other succession based pathways in that it represents mainly vertically stratified stands (i.e. coverstate = 'Du1', 'Du2', or 'Du3'. See Trajectory, below). The most common stand types are aspen dominated overstorey's (mainly aspen) with suppressed white spruce in the understorey.

Succession

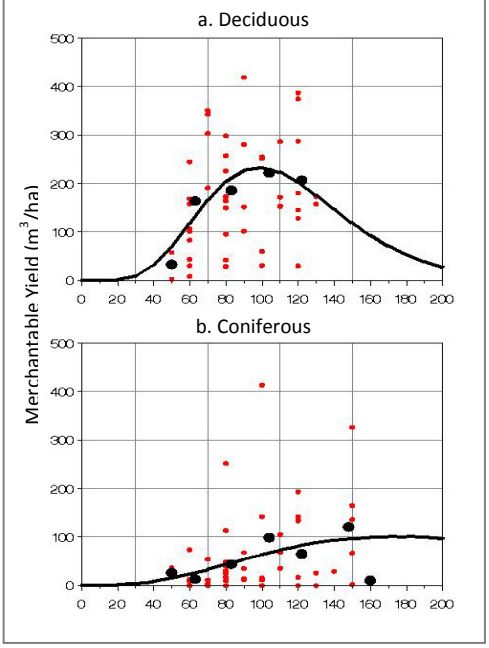
In the absence of catastrophic disturbances, stands succeed late from deciduous dominate to conifer dominate with no defined overstorey mixedwood phase in between. Rather than reach the overstorey conifers become the overstorey as a consequence of the overstorey deciduous tree mortality.

Note: Refer to Section 9.1 above for graph/table details

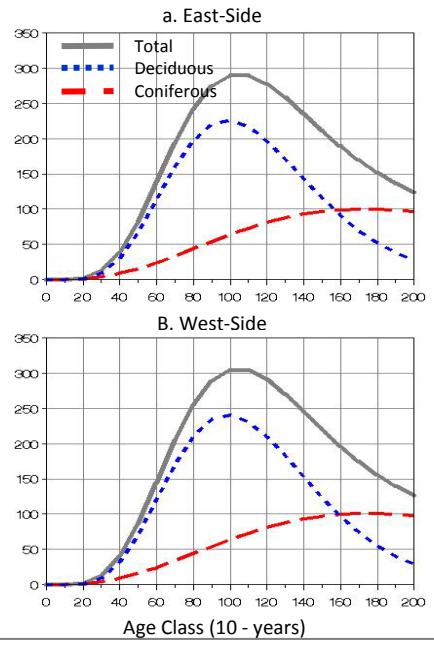
2. Current Landbase State



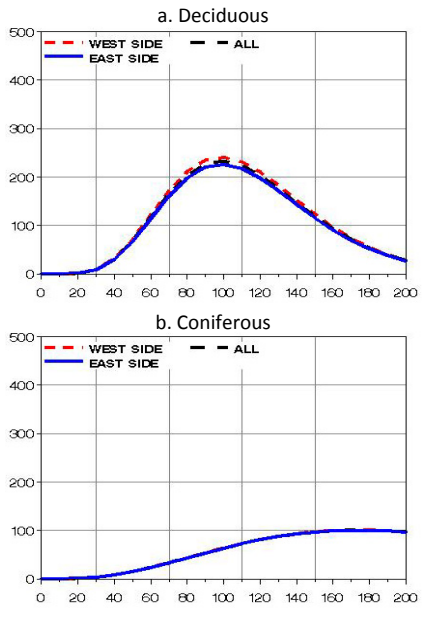
3. Base Yield Models



4. Regionalized Composite Yield



5. Compare East & West Side Models



PATHWAY 2: ASPEN >> WHITE SPRUCE Cont'd

6. Stand Trajectory

SERAL STAGE (YRS.)	0 -69	70 -109	110-149	150+
COVER-STATE	Du3	Du3, Du2	Du3, Du2, Du1	Du3, Du2, Du1, DC

7a. East Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m^3/ha)			(5) MAI (m^3/ha/yr)			(6) PIECE SIZE (stems/m^3)		(7) PIECE SIZE % of merch. vol. (m^3) by tree						(8) LAND-BASE AREA	(9) STANDING MERCH. CROP (m^3)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S	(ha)	Dec.	Con.
0	D			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	D	SI	SI	0	0	0	0.00	0.00	0.00	9.84	10.73	0	0	100	0	0	100	2,444	0	0
20	D	SE	SI	1	1	2	0.05	0.05	0.10	7.65	8.32	0	21	79	0	11	89	325	325	325
30	D	SE	SE	9	4	13	0.30	0.13	0.43	6.38	6.90	0	37	63	0	29	71	265	2,385	1,060
40	D	I	SE	30	9	39	0.75	0.23	0.98	5.47	5.90	7	41	52	5	37	58	26	780	234
50	D	I	SE	67	15	82	1.34	0.30	1.64	4.77	5.12	19	37	44	17	35	48	354	23,718	5,310
60	D	I	I	114	24	138	1.90	0.40	2.30	4.20	4.49	29	34	37	27	33	40	7,620	868,680	182,880
70	D	I	I	161	33	194	2.30	0.47	2.77	3.71	3.95	38	31	31	35	32	33	33,079	5,325,719	1,091,607
80	D	MAT	I	198	44	242	2.48	0.55	3.03	3.29	3.49	46	29	25	42	30	28	30,997	6,137,406	1,363,868
90	D	MAT	MAT	221	54	275	2.46	0.60	3.06	2.92	3.08	52	27	21	49	29	22	17,695	3,910,595	955,530
100	D	B	MAT	226	64	290	2.26	0.64	2.90	2.59	2.71	58	25	17	54	28	18	6,654	1,503,804	425,856
110	D	B	MAT	217	73	290	1.97	0.66	2.64	2.29	2.38	64	23	13	59	27	14	10,492	2,276,764	765,916
120	D	B	MAT	197	81	278	1.64	0.68	2.32	2.01	2.07	68	22	10	64	26	10	5,578	1,098,866	451,818
130	D	B	B	171	88	259	1.32	0.68	1.99	1.76	1.80	73	20	7	68	25	7	4,495	768,645	395,560
140	D	B	B	143	93	236	1.02	0.66	1.69	1.53	1.54	77	19	4	72	25	3	2,650	378,950	246,450
150	D/DC	B	B	116	97	212	0.77	0.65	1.41	1.31	1.30	81	18	1	76	24	0	1,666	193,256	161,602
160	D/DC	B	B	91	99	190	0.57	0.62	1.19	1.11	1.07	85	15	0	79	21	0	1,250	113,750	123,750
170	D/DC	B	B	69	100	170	0.41	0.59	1.00	0.92	0.86	88	12	0	83	17	0	371	25,599	37,100
180	D/DC	B	B	52	100	152	0.29	0.56	0.84	0.74	0.66	91	9	0	86	14	0	44	2,288	4,400
190	D/DC	B	B	38	99	137	0.20	0.52	0.72	0.57	0.47	94	6	0	89	11	0	8	304	792
200	D/DC	B	B	27	97	124	0.14	0.49	0.62	0.41	0.29	97	3	0	91	9	0	10	270	970

7b. West Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m^3/ha)			(5) MAI (m^3/ha/yr)			(6) PIECE SIZE (stems/m^3)		(7) PIECE SIZE % of merch. vol. (m^3) by tree						(8) LAND-BASE AREA	(9) STANDING MERCH. CROP (m^3)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S	(ha)	Dec.	Con.
0	D			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	D	SI	SI	0	0	0	0.00	0.00	0.00	9.84	10.73	0	0	100	0	0	100	2,004	0	0
20	D	SE	SI	1	1	2	0.05	0.05	0.10	7.65	8.32	0	21	79	0	11	89	288	288	288
30	D	SE	SE	9	4	13	0.30	0.13	0.43	6.38	6.90	0	37	63	0	29	71	623	5,607	2,492
40	D	I	SE	32	9	41	0.80	0.23	1.03	5.47	5.90	7	41	52	5	37	58	1,175	37,600	10,575
50	D	I	SE	71	16	87	1.42	0.32	1.74	4.77	5.12	19	37	44	17	35	48	319	22,649	5,104
60	D	I	I	121	24	145	2.02	0.40	2.42	4.20	4.49	29	34	37	27	33	40	1,047	126,687	25,128
70	D	I	I	171	34	205	2.44	0.49	2.93	3.71	3.95	38	31	31	35	32	33	4,198	717,858	142,732
80	D	MAT	I	211	44	255	2.64	0.55	3.19	3.29	3.49	46	29	25	42	30	28	7,541	1,591,151	331,804
90	D	MAT	MAT	235	54	289	2.61	0.60	3.21	2.92	3.08	52	27	21	49	29	22	5,893	1,384,855	318,222
100	D	B	MAT	241	64	305	2.41	0.64	3.05	2.59	2.71	58	25	17	54	28	18	10,512	2,533,392	672,768
110	D	B	MAT	231	73	305	2.10	0.66	2.77	2.29	2.38	64	23	13	59	27	14	19,471	4,497,801	1,421,383
120	D	B	MAT	210	81	292	1.75	0.68	2.43	2.01	2.07	68	22	10	64	26	10	6,713	1,409,730	543,753
130	D	B	B	183	88	271	1.41	0.68	2.08	1.76	1.80	73	20	7	68	25	7	3,491	638,853	307,208
140	D	B	B	153	93	246	1.09	0.66	1.76	1.53	1.54	77	19	4	72	25	3	1,267	193,851	117,831
150	D/DC	B	B	123	97	221	0.82	0.65	1.47	1.31	1.30	81	18	1	76	24	0	826	101,598	80,122
160	D/DC	B	B	97	100	196	0.61	0.63	1.23	1.11	1.07	85	15	0	79	21	0	247	23,959	24,700
170	D/DC	B	B	74	101	175	0.44	0.59	1.03	0.92	0.86	88	12	0	83	17	0	379	28,046	38,279
180	D/DC	B	B	55	101	156	0.31	0.56	0.87	0.74	0.66	91	9	0	86	14	0	136	7,480	13,736
190	D/DC	B	B	40	100	140	0.21	0.53	0.74	0.57	0.47	94	6	0	89	11	0	14	560	1,400
200	D/DC	B	B	29	98	127	0.15	0.49	0.64	0.41	0.29	97	3	0	91	9	0	0	0	0

PATHWAY 3: ASPEN >> LATE MIXEDWOOD>>WHITE SPRUCE

1. AVI Criteria

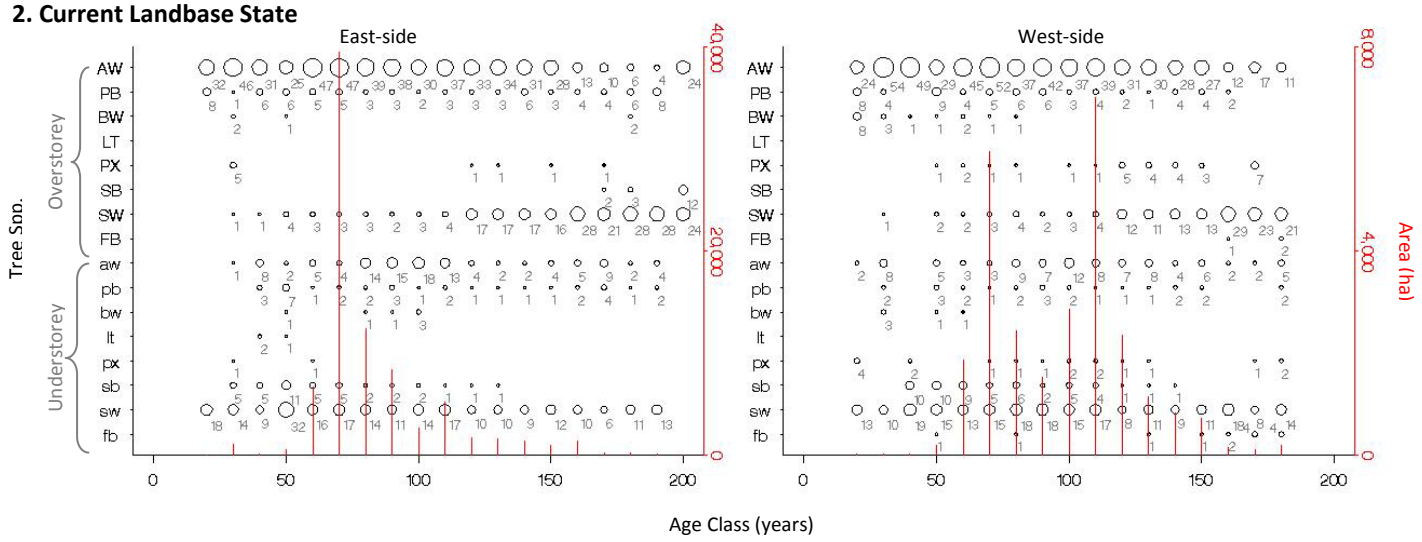
Pathway 3 is a succession based pathway where pine species, black spruce and/or Larch are: 1) less than or equal to 20% of the overstory tree species composition and; 2) less than or equal to 40% of the understorey tree species composition. Pathway 3 is a compositionally diverse pathway that is seperated from the other succession based pathways in that it is made up of both vertically stratified stands (i.e. coverstate = 'Du2', or 'Du3') and overstorey mixedwoods (i.e. coverstate = 'DC' or 'CD') at different age classes (See Trajectory, below). The most common stand types include: aspen dominated overstories with suppressed to intermediate white spruce understories; aspen leading mixedwoods and white spruce leading mixedwoods.

Succession

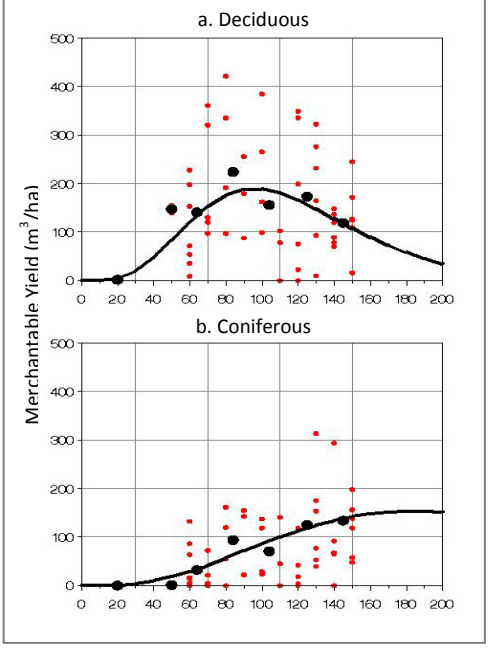
Stands succeed from deciduous dominate to conifer dominate with a late but well-defined overstorey mixedwood phase in between.

Note: Refer to Section 9.1 above for graph/table details

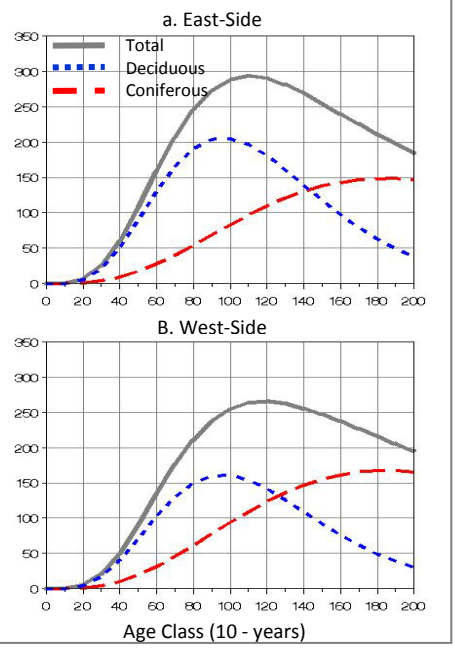
2. Current Landbase State



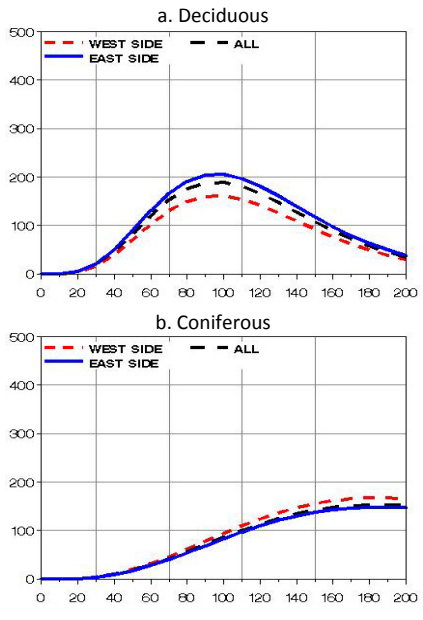
3. Base Yield Models



4. Regionalized Composite Yield



5. Compare East & West Side Models



PATHWAY 3: ASPEN >> LATE MIXEDWOOD>>WHITE SPRUCE Cont'd

6. Stand Trajectory

SERAL STAGE (YRS.)	0 -69	70 -109	110-149	150+
COVER-STATE	Du2	Du1	DC	CD

7a. East Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m³/ha)			(5) MAI (m³/ha/yr)			(6) PIECE SIZE (stems/m³)		(7) PIECE SIZE % of merch. vol. (m³) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m³)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	D			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	D	SI	SI	0	0	0	0.00	0.00	0.00	9.74	10.71	0	0	100	0	0	100	1,594	0	0
20	D	SE	SI	5	1	6	0.25	0.05	0.30	7.53	8.28	0	21	79	0	7	93	130	650	130
30	D	SE	SE	21	4	25	0.70	0.13	0.83	6.24	6.86	0	37	63	0	24	76	2,443	51,303	9,772
40	D	I	SE	51	9	60	1.28	0.23	1.50	5.32	5.86	8	40	52	9	27	64	379	19,329	3,411
50	D	I	SE	90	17	108	1.80	0.34	2.16	4.61	5.08	21	36	43	21	25	54	639	57,510	10,863
60	D	I	I	131	28	159	2.18	0.47	2.65	4.03	4.44	32	33	35	31	23	46	7,770	1,017,870	217,560
70	D	I	I	166	40	207	2.37	0.57	2.96	3.53	3.90	40	30	30	39	21	40	42,009	6,973,494	1,680,360
80	D	MAT	I	191	54	246	2.39	0.68	3.08	3.11	3.44	47	27	26	46	19	35	13,110	2,504,010	707,940
90	D	MAT	MAT	204	69	273	2.27	0.77	3.03	2.73	3.02	54	25	21	52	18	30	9,033	1,842,732	623,277
100	D	B	MAT	205	83	288	2.05	0.83	2.88	2.40	2.66	60	23	17	58	17	25	3,131	641,855	259,873
110	DC	B	MAT	197	97	294	1.79	0.88	2.67	2.09	2.32	66	21	13	64	15	21	5,541	1,091,577	537,477
120	DC	B	MAT	181	110	291	1.51	0.92	2.43	1.81	2.02	70	20	10	68	14	18	1,837	332,497	202,070
130	DC	B	B	161	121	282	1.24	0.93	2.17	1.56	1.74	75	18	7	73	13	14	1,738	279,818	210,298
140	DC	B	B	139	130	270	0.99	0.93	1.93	1.32	1.48	79	17	4	77	12	11	1,389	193,071	180,570
150	CD	B	B	118	138	255	0.79	0.92	1.70	1.10	1.24	83	16	1	81	11	8	1,124	132,632	155,112
160	CD	B	B	97	143	240	0.61	0.89	1.50	0.90	1.01	87	13	0	84	11	5	1,476	143,172	211,068
170	CD	B	B	79	147	226	0.46	0.86	1.33	0.70	0.80	90	10	0	87	10	3	252	19,908	37,044
180	CD	B	B	63	148	211	0.35	0.82	1.17	0.52	0.60	94	6	0	90	9	1	181	11,403	26,788
190	CD	B	B	49	149	198	0.26	0.78	1.04	0.35	0.41	97	3	0	93	7	0	10	490	1,490
200	CD	B	B	38	147	185	0.19	0.74	0.93	0.19	0.23	99	1	0	96	4	0	7	266	1,029

7b. West Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m³/ha)			(5) MAI (m³/ha/yr)			(6) PIECE SIZE (stems/m³)		(7) PIECE SIZE % of merch. vol. (m³) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m³)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	D			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	D	SI	SI	0	0	0	0.00	0.00	0.00	9.74	10.71	0	0	100	0	0	100	942	0	0
20	D	SE	SI	4	1	5	0.20	0.05	0.25	7.53	8.28	0	21	79	0	7	93	165	660	165
30	D	SE	SE	17	4	21	0.57	0.13	0.70	6.24	6.86	0	37	63	0	24	76	941	15,997	3,764
40	D	I	SE	40	10	50	1.00	0.25	1.25	5.32	5.86	8	40	52	9	27	64	489	19,560	4,890
50	D	I	SE	71	20	90	1.42	0.40	1.80	4.61	5.08	21	36	43	21	25	54	291	20,661	5,820
60	D	I	I	103	31	134	1.72	0.52	2.23	4.03	4.44	32	33	35	31	23	46	2,217	228,351	68,727
70	D	I	I	130	46	176	1.86	0.66	2.51	3.53	3.90	40	30	30	39	21	40	6,331	823,030	291,226
80	D	MAT	I	150	61	211	1.88	0.76	2.64	3.11	3.44	47	27	26	46	19	35	2,850	427,500	173,850
90	D	MAT	MAT	160	78	238	1.78	0.87	2.64	2.73	3.02	54	25	21	52	18	30	1,716	274,560	133,848
100	D	B	MAT	161	94	255	1.61	0.94	2.55	2.40	2.66	60	23	17	58	17	25	3,129	503,769	294,126
110	DC	B	MAT	154	109	264	1.40	0.99	2.40	2.09	2.32	66	21	13	64	15	21	7,599	1,170,246	828,291
120	DC	B	MAT	142	124	266	1.18	1.03	2.22	1.81	2.02	70	20	10	68	14	18	2,664	378,288	330,336
130	DC	B	B	126	136	263	0.97	1.05	2.02	1.56	1.74	75	18	7	73	13	14	1,292	162,792	175,712
140	DC	B	B	109	147	256	0.78	1.05	1.83	1.32	1.48	79	17	4	77	12	11	890	97,010	130,830
150	CD	B	B	92	155	248	0.61	1.03	1.65	1.10	1.24	83	16	1	81	11	8	765	70,380	118,575
160	CD	B	B	76	161	238	0.48	1.01	1.49	0.90	1.01	87	13	0	84	11	5	163	12,388	26,243
170	CD	B	B	62	166	227	0.36	0.98	1.34	0.70	0.80	90	10	0	87	10	3	112	6,944	18,592
180	CD	B	B	49	167	217	0.27	0.93	1.21	0.52	0.60	94	6	0	90	9	1	189	9,261	31,563
190	CD	B	B	39	168	206	0.21	0.88	1.08	0.35	0.41	97	3	0	93	7	0	0	0	0
200	CD	B	B	30	166	196	0.15	0.83	0.98	0.19	0.23	99	1	0	96	4	0	0	0	0

PATHWAY 4: ASPEN >> EARLY MIXEDWOOD>>WHITE SPRUCE

1. AVI Criteria

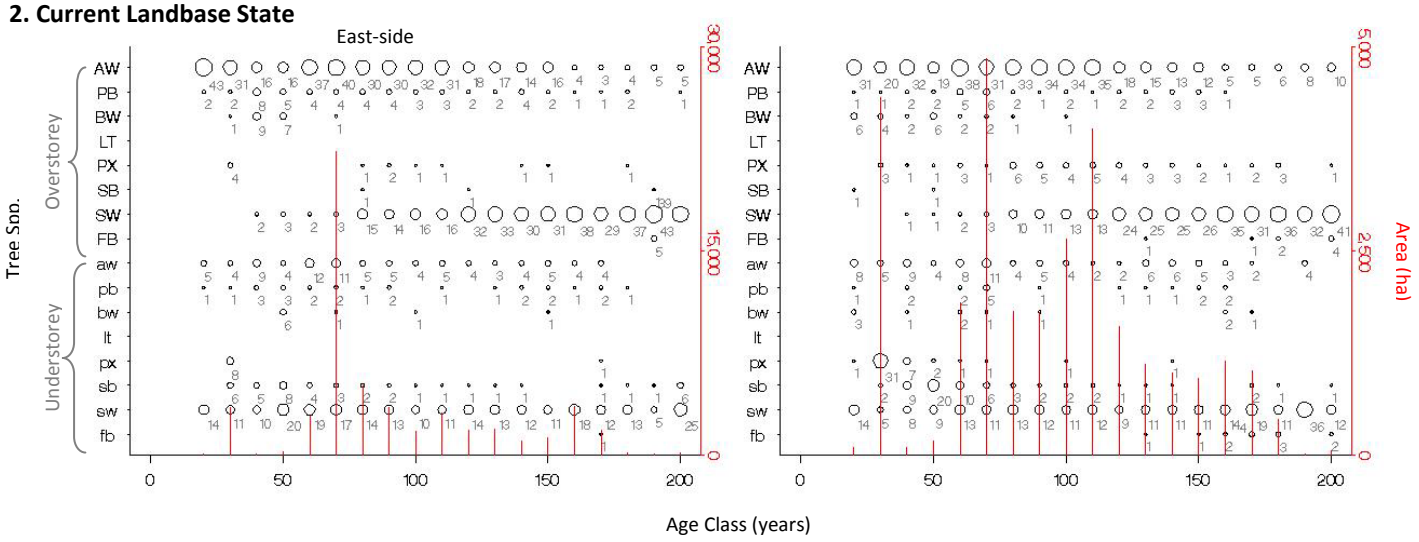
Pathway 4 is a succession based pathway where pine species, black spruce and/or Larch are: 1) less than or equal to 20% of the overstory tree species composition and; 2) less than or equal to 40% of the understorey tree species composition. Pathway 4 is the most diverse of the succession pathways and is seperated from them in that it is made up of vertically stratified stands (i.e. coverstate = 'Du1'); overstorey mixedwoods (i.e. coverstate = 'DC' or 'CD') and conifer dominated stands (i.e. coverstate='Cd') at different age classes (See Trajectory, below). The most common stand types include: aspen dominated overstories with intermediate white spruce understories; aspen leading mixedwoods; white spruce leading mixedwoods; and white spruce dominated stands.

Succession

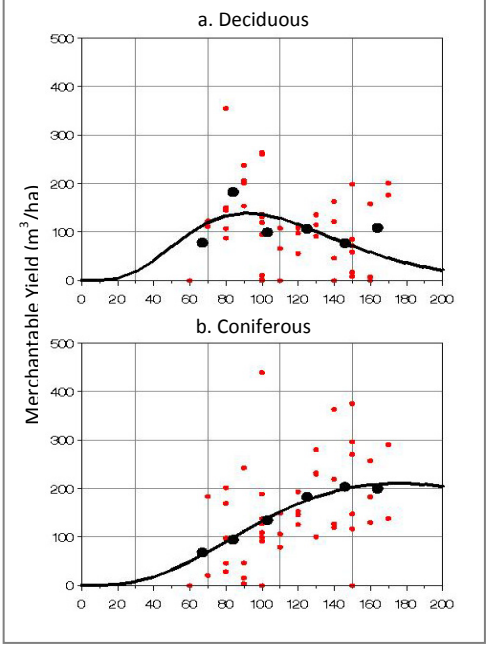
Stands succeed from deciduous dominate to conifer dominate with an early and well-defined overstorey mixedwood phase in between.

Note: Refer to Section 9.1 above for graph/table details

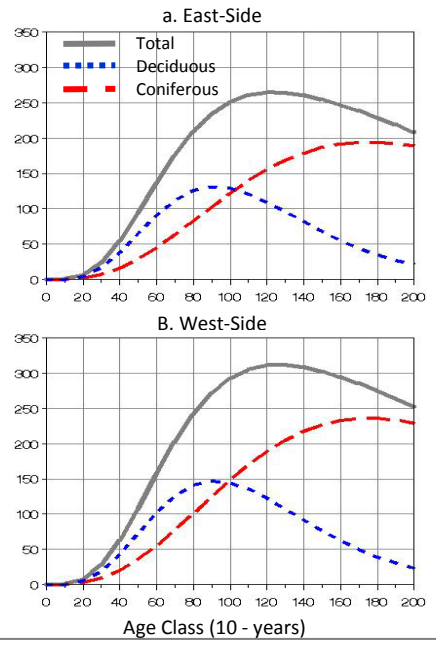
2. Current Landbase State



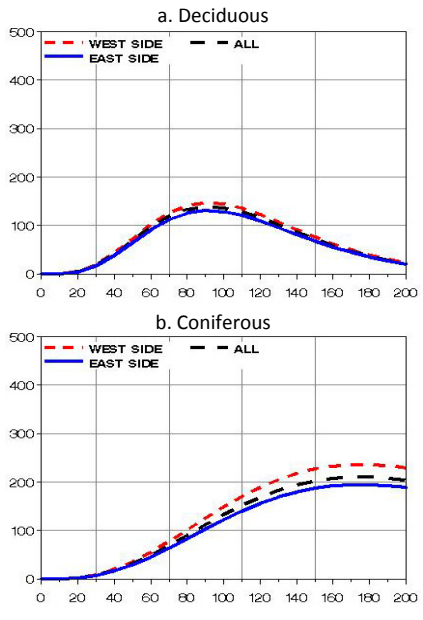
3. Base Yield Models



4. Regionalized Composite Yield



5. Compare East & West Side Models



PATHWAY 4: ASPEN >> EARLY MIXEDWOOD>>WHITE SPRUCE Cont'd

6. Stand Trajectory

SERAL STAGE (YRS.)	0 -69	70 -109	110-149	150+
COVER-STATE	Du1	DC	CD	Cd

7a. East Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m^3/ha)			(5) MAI (m^3/ha/yr)			(6) PIECE SIZE (stems/m^3)		(7) PIECE SIZE % of merch. vol. (m^3) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m^3)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	D			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	D	SI	SI	0	0	1	0.00	0.00	0.10	9.68	10.62	0	0	100	0	0	100	1,361	0	0
20	D	SE	SI	4	2	6	0.20	0.10	0.30	7.45	8.17	0	20	80	0	13	87	342	1,368	684
30	D	SE	SE	17	7	24	0.57	0.23	0.80	6.14	6.74	0	36	64	1	30	69	5,721	97,257	40,047
40	D	I	SE	38	16	55	0.95	0.40	1.38	5.22	5.73	10	37	53	17	26	57	228	8,664	3,648
50	D	I	SE	65	29	94	1.30	0.58	1.88	4.50	4.94	22	33	45	30	24	46	323	20,995	9,367
60	D	I	I	91	45	136	1.52	0.75	2.27	3.91	4.29	32	30	38	40	21	39	3,299	300,209	148,455
70	DC	I	I	112	64	176	1.60	0.91	2.51	3.42	3.75	41	27	32	48	20	32	23,346	2,614,752	1,494,144
80	DC	MAT	I	126	83	209	1.58	1.04	2.61	2.99	3.28	49	24	27	56	18	26	5,693	717,318	472,519
90	DC	MAT	MAT	131	103	234	1.46	1.14	2.60	2.61	2.86	56	22	22	63	16	21	3,944	516,664	406,232
100	DC	B	MAT	129	122	251	1.29	1.22	2.51	2.27	2.49	62	20	18	69	15	16	2,137	275,673	260,714
110	CD	B	MAT	121	140	261	1.10	1.27	2.37	1.96	2.15	67	18	15	74	14	12	3,796	459,316	531,440
120	CD	B	MAT	109	156	265	0.91	1.30	2.21	1.68	1.85	72	17	11	79	13	8	2,118	230,862	330,408
130	CD	B	B	96	169	264	0.74	1.30	2.03	1.43	1.56	77	15	8	84	12	4	2,343	224,928	395,967
140	CD	B	B	82	179	261	0.59	1.28	1.86	1.19	1.30	81	14	5	88	11	1	1,252	102,664	224,108
150	C	B	B	68	187	255	0.45	1.25	1.70	0.97	1.06	84	13	3	92	8	0	1,631	110,908	304,997
160	C	B	B	55	192	247	0.34	1.20	1.54	0.76	0.83	88	11	1	96	4	0	4,054	222,970	778,368
170	C	B	B	44	194	239	0.26	1.14	1.41	0.56	0.62	92	8	0	99	1	0	2,028	89,232	393,432
180	C	B	B	35	194	229	0.19	1.08	1.27	0.38	0.41	95	5	0	100	0	0	289	10,115	56,066
190	C	B	B	27	192	220	0.14	1.01	1.16	0.21	0.22	98	2	0	100	0	0	91	2,457	17,472
200	C	B	B	21	189	209	0.11	0.95	1.05	0.15	0.15	100	0	0	100	0	0	94	1,974	17,766

7b. West Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m^3/ha)			(5) MAI (m^3/ha/yr)			(6) PIECE SIZE (stems/m^3)		(7) PIECE SIZE % of merch. vol. (m^3) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m^3)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	D			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	D	SI	SI	0	0	1	0.00	0.00	0.10	9.68	10.62	0	0	100	0	0	100	1,219	0	0
20	D	SE	SI	5	3	7	0.25	0.15	0.35	7.45	8.17	0	20	80	0	13	87	1,021	5,105	3,063
30	D	SE	SE	19	9	28	0.63	0.30	0.93	6.14	6.74	0	36	64	1	30	69	5,986	113,734	53,874
40	D	I	SE	43	20	63	1.08	0.50	1.58	5.22	5.73	10	37	53	17	26	57	1,049	45,107	20,980
50	D	I	SE	73	36	108	1.46	0.72	2.16	4.50	4.94	22	33	45	30	24	46	297	21,681	10,692
60	D	I	I	102	55	157	1.70	0.92	2.62	3.91	4.29	32	30	38	40	21	39	2,221	226,542	122,155
70	DC	I	I	126	78	203	1.80	1.11	2.90	3.42	3.75	41	27	32	48	20	32	5,135	647,010	400,530
80	DC	MAT	I	141	101	242	1.76	1.26	3.03	2.99	3.28	49	24	27	56	18	26	2,106	296,946	212,706
90	DC	MAT	MAT	147	125	272	1.63	1.39	3.02	2.61	2.86	56	22	22	63	16	21	1,976	290,472	247,000
100	DC	B	MAT	144	149	293	1.44	1.49	2.93	2.27	2.49	62	20	18	69	15	16	3,057	440,208	455,493
110	CD	B	MAT	136	170	306	1.24	1.55	2.78	1.96	2.15	67	18	15	74	14	12	4,687	637,432	796,790
120	CD	B	MAT	123	189	312	1.03	1.58	2.60	1.68	1.85	72	17	11	79	13	8	1,876	230,748	354,564
130	CD	B	B	107	205	312	0.82	1.58	2.40	1.43	1.56	77	15	8	84	12	4	1,278	136,746	261,990
140	CD	B	B	92	218	309	0.66	1.56	2.21	1.19	1.30	81	14	5	88	11	1	1,264	116,288	275,552
150	C	B	B	76	227	303	0.51	1.51	2.02	0.97	1.06	84	13	3	92	8	0	1,030	78,280	233,810
160	C	B	B	62	233	295	0.39	1.46	1.84	0.76	0.83	88	11	1	96	4	0	1,399	86,738	325,967
170	C	B	B	50	236	286	0.29	1.39	1.68	0.56	0.62	92	8	0	99	1	0	1,149	57,450	271,164
180	C	B	B	39	236	275	0.22	1.31	1.53	0.38	0.41	95	5	0	100	0	0	471	18,369	111,156
190	C	B	B	31	234	264	0.16	1.23	1.39	0.21	0.22	98	2	0	100	0	0	9	279	2,106
200	C	B	B	23	229	253	0.12	1.15	1.27	0.15	0.15	100	0	0	100	0	0	71	1,633	16,259

PATHWAY 5: ASPEN MIXEDWOOD >>WHITE SPRUCE

1. AVI Criteria

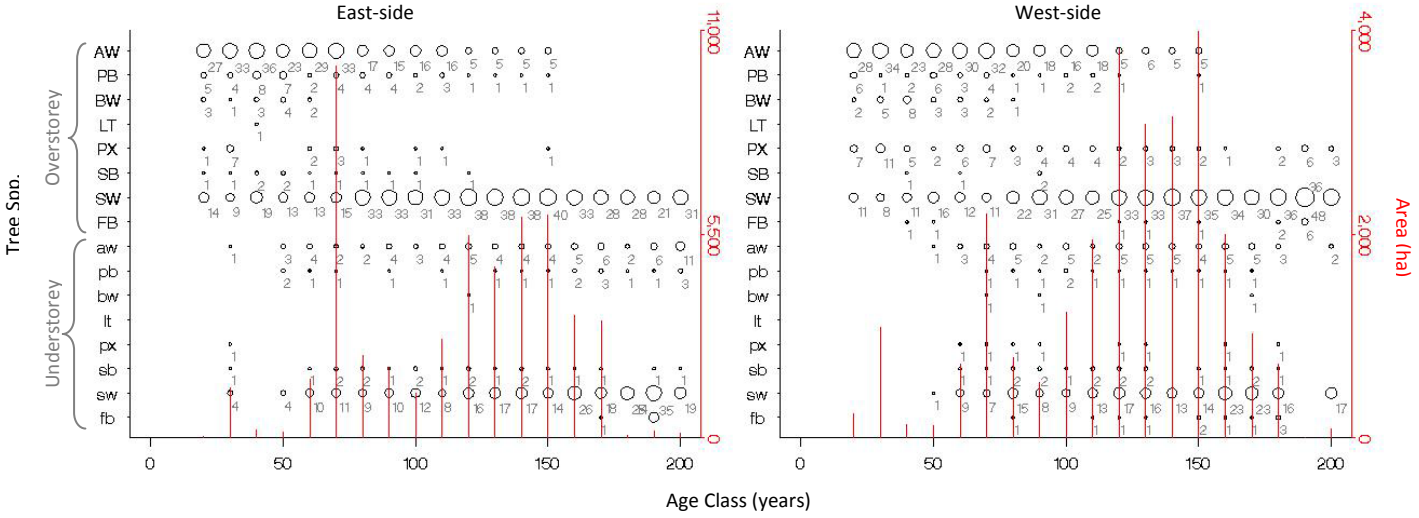
Pathway 5 is a succession based pathway where pine species, black spruce and/or Larch are: 1) less than or equal to 20% of the overstory tree species composition and; 2) less than or equal to 40% of the understorey tree species composition. Pathway 5 is seperated from the other succession based pathways in that it is made up overstorey mixedwoods (i.e. coverstate = 'DC' or 'CD') and conifer dominated stands (i.e. coverstate='Cd' or 'Cp') at different age classes (See Trajectory, below). The most common stand types include: aspen leading mixedwoods; white spruce leading mixedwoods; and white spruce dominated or pure stands.

Succession

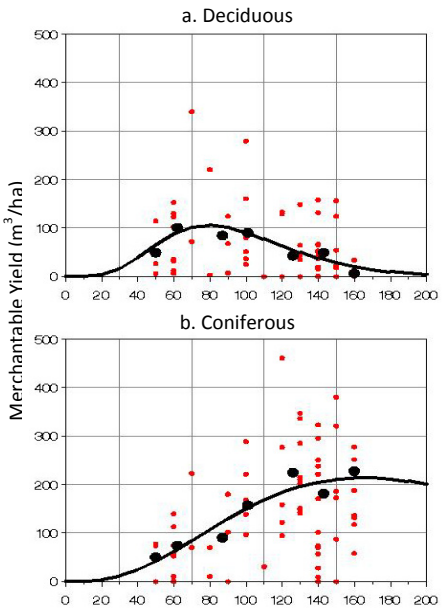
Stands succeed early from a decidous leading mixedwood overstorey, to a conifer leading mixedwood overstorey than to a conifer dominated overstorey. This pathway converges with Pathway 6 after 150 years.

Note: Refer to Section 9.1 above for graph/table details

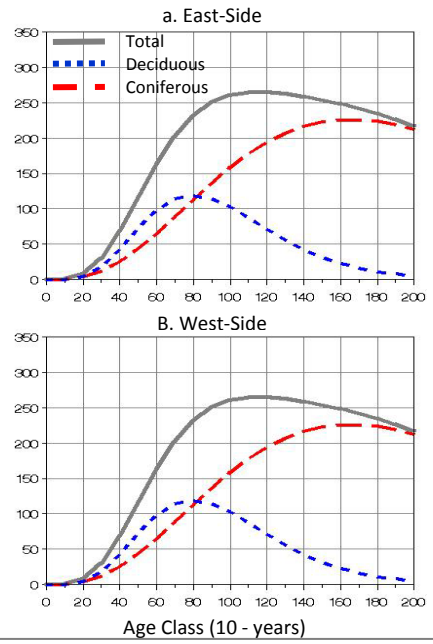
2. Current Landbase State



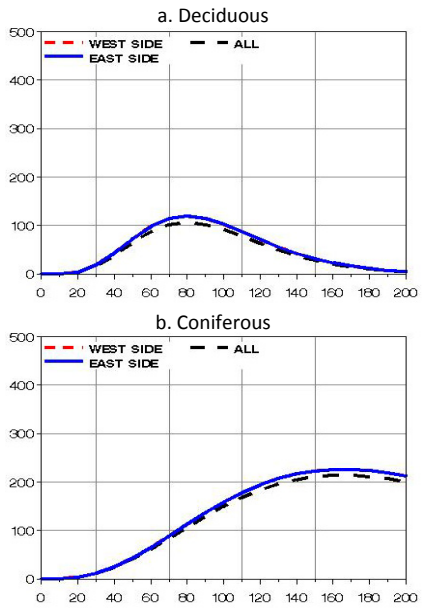
3. Base Yield Models



4. Regionalized Composite Yield



5. Compare East & West Side Models



PATHWAY 5: ASPEN MIXEDWOOD >> WHITE SPRUCE Cont'd

6. Stand Trajectory

SERAL STAGE (YRS.)	0 -69	70 -109	110-149	150+
COVER-STATE	DC	CD	Cd	Cp

7a. East Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m^3/ha)			(5) MAI (m^3/ha/yr)			(6) PIECE SIZE (stems/m^3)		(7) PIECE SIZE % of merch. vol. (m^3) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m^3)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	DC			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	DC	SI	SI	0	0	1	0.00	0.00	0.10	10.05	10.86	0	0	100	0	0	100	1,278	0	0
20	DC	SE	SI	4	4	8	0.20	0.20	0.40	7.93	8.49	0	10	90	0	8	92	428	1,712	1,712
30	DC	SE	SE	18	12	30	0.60	0.40	1.00	6.69	7.10	0	25	75	0	25	75	2,185	39,330	26,220
40	DC	I	SE	43	25	69	1.08	0.63	1.73	5.81	6.11	0	35	65	8	29	63	417	17,931	10,425
50	DC	I	SE	73	44	116	1.46	0.88	2.32	5.13	5.35	6	37	57	20	27	53	428	31,244	18,832
60	DC	I	I	98	65	163	1.63	1.08	2.72	4.57	4.72	16	33	51	30	25	45	2,314	226,772	150,410
70	CD	I	I	114	89	203	1.63	1.27	2.90	4.10	4.19	24	31	45	38	23	39	11,692	1,332,888	1,040,588
80	CD	MAT	I	119	113	232	1.49	1.41	2.90	3.69	3.74	31	28	41	46	21	33	2,734	325,346	308,942
90	CD	MAT	MAT	114	137	251	1.27	1.52	2.79	3.33	3.33	37	26	37	52	20	28	2,342	266,988	320,854
100	CD	B	MAT	103	159	261	1.03	1.59	2.61	3.01	2.97	43	24	33	58	19	23	1,357	139,771	215,763
110	C	B	MAT	87	178	265	0.79	1.62	2.41	2.72	2.64	48	22	30	63	18	19	3,382	294,234	601,996
120	C	B	MAT	71	194	265	0.59	1.62	2.21	2.45	2.35	52	21	27	67	17	16	6,153	436,863	1,193,682
130	C	B	B	56	207	263	0.43	1.59	2.02	2.21	2.07	57	19	24	72	16	12	5,628	315,168	1,164,996
140	C	B	B	42	217	259	0.30	1.55	1.85	1.98	1.82	60	19	21	76	15	9	6,412	269,304	1,391,404
150	C	B	B	31	223	254	0.21	1.49	1.69	1.77	1.58	64	17	19	80	14	6	7,106	220,286	1,584,638
160	C	B	B	23	226	249	0.14	1.41	1.56	1.57	1.36	67	16	17	83	13	4	0	0	0
170	C	B	B	16	226	242	0.09	1.33	1.42	1.39	1.15	70	15	15	87	12	1	0	0	0
180	C	B	B	11	224	235	0.06	1.24	1.31	1.21	0.96	73	14	13	90	10	0	0	0	0
190	C	B	B	8	219	227	0.04	1.15	1.19	1.05	0.77	76	13	11	93	7	0	0	0	0
200	C	B	B	5	212	218	0.03	1.06	1.09	0.89	0.60	79	12	9	96	4	0	0	0	0

7b. West Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m^3/ha)			(5) MAI (m^3/ha/yr)			(6) PIECE SIZE (stems/m^3)		(7) PIECE SIZE % of merch. vol. (m^3) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m^3)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	DC			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	DC	SI	SI	0	0	1	0.00	0.00	0.10	10.05	10.86	0	0	100	0	0	100	1,600	0	0
20	DC	SE	SI	4	4	8	0.20	0.20	0.40	7.93	8.49	0	10	90	0	8	92	3,360	13,440	13,440
30	DC	SE	SE	18	12	30	0.60	0.40	1.00	6.69	7.10	0	25	75	0	25	75	2,975	53,550	35,700
40	DC	I	SE	43	25	69	1.08	0.63	1.73	5.81	6.11	0	35	65	8	29	63	753	32,379	18,825
50	DC	I	SE	73	44	116	1.46	0.88	2.32	5.13	5.35	6	37	57	20	27	53	470	34,310	20,680
60	DC	I	I	98	65	163	1.63	1.08	2.72	4.57	4.72	16	33	51	30	25	45	1,064	104,272	69,160
70	CD	I	I	114	89	203	1.63	1.27	2.90	4.10	4.19	24	31	45	38	23	39	2,675	304,950	238,075
80	CD	MAT	I	119	113	232	1.49	1.41	2.90	3.69	3.74	31	28	41	46	21	33	943	112,217	106,559
90	CD	MAT	MAT	114	137	251	1.27	1.52	2.79	3.33	3.33	37	26	37	52	20	28	777	88,578	106,449
100	CD	B	MAT	103	159	261	1.03	1.59	2.61	3.01	2.97	43	24	33	58	19	23	1,417	145,951	225,303
110	C	B	MAT	87	178	265	0.79	1.62	2.41	2.72	2.64	48	22	30	63	18	19	2,320	201,840	412,960
120	C	B	MAT	71	194	265	0.59	1.62	2.21	2.45	2.35	52	21	27	67	17	16	4,466	317,086	866,404
130	C	B	B	56	207	263	0.43	1.59	2.02	2.21	2.07	57	19	24	72	16	12	3,825	214,200	791,775
140	C	B	B	42	217	259	0.30	1.55	1.85	1.98	1.82	60	19	21	76	15	9	3,828	160,776	830,676
150	C	B	B	31	223	254	0.21	1.49	1.69	1.77	1.58	64	17	19	80	14	6	4,634	143,654	1,033,382
160	C	B	B	23	226	249	0.14	1.41	1.56	1.57	1.36	67	16	17	83	13	4	3	69	678
170	C	B	B	16	226	242	0.09	1.33	1.42	1.39	1.15	70	15	15	87	12	1	0	0	0
180	C	B	B	11	224	235	0.06	1.24	1.31	1.21	0.96	73	14	13	90	10	0	0	0	0
190	C	B	B	8	219	227	0.04	1.15	1.19	1.05	0.77	76	13	11	93	7	0	0	0	0
200	C	B	B	5	212	218	0.03	1.06	1.09	0.89	0.60	79	12	9	96	4	0	0	0	0

PATHWAY 6: WHITE SPRUCE >> WHITE SPRUCE

1. AVI Criteria

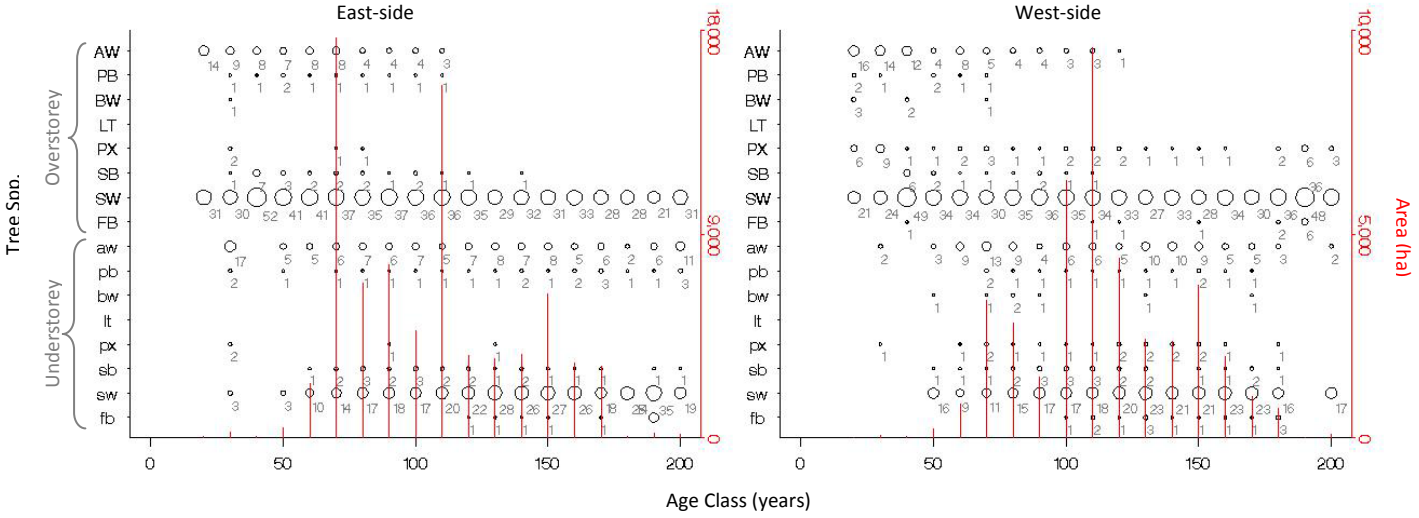
Pathway 6 is a succession based pathway where pine species, black spruce and/or Larch are: 1) less than or equal to 20% of the overstory tree species composition and; 2) less than or equal to 40% of the understorey tree species composition. Pathway 6 is seperated from the other succession based pathways in that it is made up of primarily conifer dominated coverstates. i.e. coverstate='Cd' or 'Cp' (See Trajectory, below). The most common stand types are white spruce dominated stands.

Succession

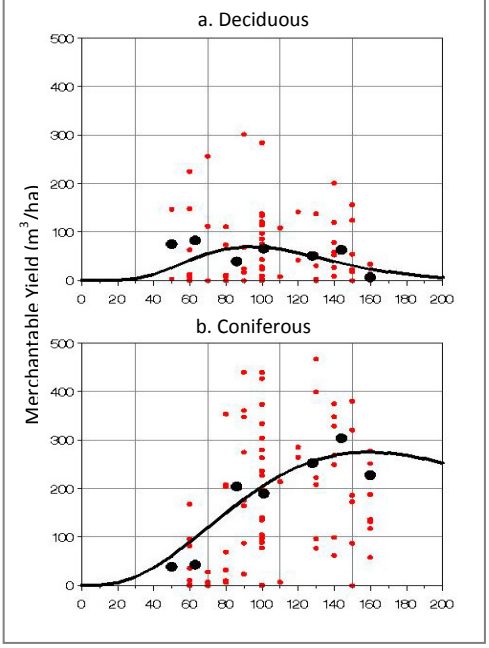
Stands succeed early to pure conifer stands from conifer leading or conifer dominated stands.

Note: Refer to Section 9.1 above for graph/table details

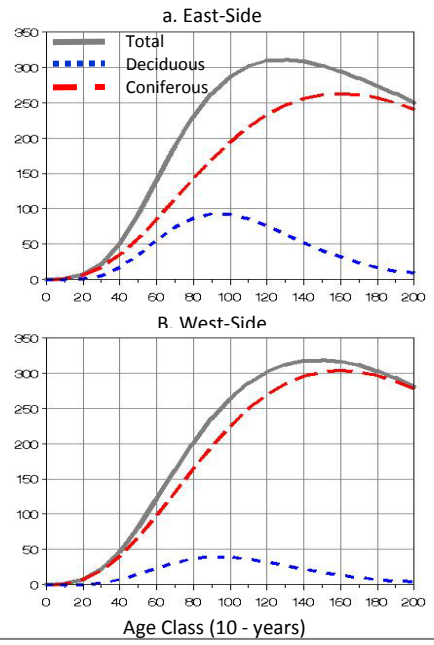
2. Current Landbase State



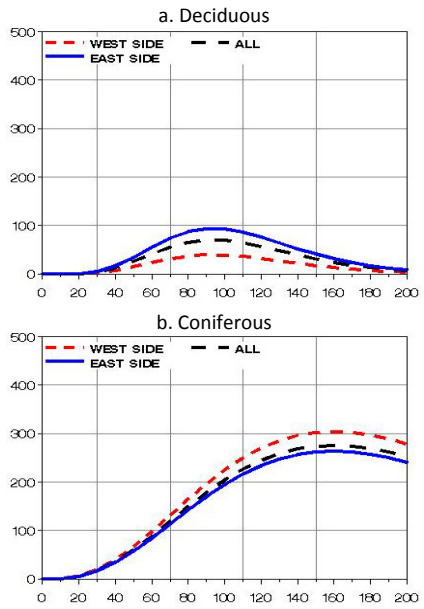
3. Base Yield Models



4. Regionalized Composite Yield



5. Compare East & West Side Models



PATHWAY 6: WHITE SPRUCE >> WHITE SPRUCE Cont'd

6. Stand Trajectory

SERAL STAGE (YRS.)	0 -69	70 -109	110-149	150+
COVER-STATE	CD, Cd, Cp	Cd, Cp	Cp	Cp

7a. East Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m^3/ha)			(5) MAI (m^3/ha/yr)			(6) PIECE SIZE (stems/m^3)		(7) PIECE SIZE % of merch. vol. (m^3) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m^3)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	CD/C			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	CD/C	SI	SI	0	1	1	0.00	0.10	0.10	10.01	10.65	0	0	100	0	0	100	1,750	0	1,750
20	CD/C	SE	SI	1	6	7	0.05	0.30	0.35	7.88	8.21	0	12	88	0	6	94	1,235	1,235	7,410
30	CD/C	SE	SE	5	17	22	0.17	0.57	0.73	6.64	6.79	0	27	73	0	24	76	714	3,570	12,138
40	CD/C	I	SE	17	35	51	0.43	0.88	1.28	5.76	5.78	0	37	63	9	27	64	147	2,499	5,145
50	CD/C	I	SE	35	58	92	0.70	1.16	1.84	5.07	4.99	11	34	55	21	24	55	1,044	36,540	60,552
60	CD/C	I	I	55	85	140	0.92	1.42	2.33	4.51	4.35	21	31	48	31	22	47	3,682	202,510	312,970
70	C	I	I	74	114	188	1.06	1.63	2.69	4.04	3.81	29	28	43	39	20	41	21,919	1,622,006	2,498,766
80	C	MAT	I	87	143	230	1.09	1.79	2.88	3.63	3.34	36	26	38	46	19	35	9,024	785,088	1,290,432
90	C	MAT	MAT	93	170	263	1.03	1.89	2.92	3.27	2.92	42	24	34	53	17	30	9,614	894,102	1,634,380
100	C	B	MAT	92	195	287	0.92	1.95	2.87	2.94	2.55	48	22	30	59	16	25	5,689	523,388	1,109,355
110	C	B	MAT	86	216	302	0.78	1.96	2.75	2.65	2.22	53	20	27	64	15	21	17,995	1,547,570	3,886,920
120	C	B	MAT	76	234	310	0.63	1.95	2.58	2.38	1.91	58	18	24	68	14	18	4,365	331,740	1,021,410
130	C	B	B	64	247	311	0.49	1.90	2.39	2.14	1.63	62	17	21	73	13	14	4,317	276,288	1,066,299
140	C	B	B	52	256	309	0.37	1.83	2.21	1.91	1.37	66	16	18	77	12	11	4,394	228,488	1,124,864
150	C	B	B	41	262	303	0.27	1.75	2.02	1.70	1.12	70	14	16	81	11	8	7,183	294,503	1,881,946
160	C	B	B	32	263	295	0.20	1.64	1.84	1.50	0.90	74	13	13	84	10	6	3,678	117,696	967,314
170	C	B	B	24	262	285	0.14	1.54	1.68	1.31	0.68	77	12	11	88	9	3	3,398	81,552	890,276
180	C	B	B	17	257	274	0.09	1.43	1.52	1.14	0.48	80	11	9	90	9	1	177	3,009	45,489
190	C	B	B	12	250	263	0.06	1.32	1.38	0.97	0.29	83	10	7	94	6	0	210	2,520	52,500
200	C	B	B	9	241	250	0.05	1.21	1.25	0.81	0.15	86	9	5	97	3	0	184	1,656	44,344

7b. West Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m^3/ha)			(5) MAI (m^3/ha/yr)			(6) PIECE SIZE (stems/m^3)		(7) PIECE SIZE % of merch. vol. (m^3) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m^3)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	CD/C			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	CD/C	SI	SI	0	1	1	0.00	0.10	0.10	10.01	10.65	0	0	100	0	0	100	1,953	0	1,953
20	CD/C	SE	SI	0	7	7	0.00	0.35	0.35	7.88	8.21	0	12	88	0	6	94	658	0	4,606
30	CD/C	SE	SE	2	20	22	0.07	0.67	0.73	6.64	6.79	0	27	73	0	24	76	507	1,014	10,140
40	CD/C	I	SE	7	40	47	0.18	1.00	1.18	5.76	5.78	0	37	63	9	27	64	718	5,026	28,720
50	CD/C	I	SE	15	67	81	0.30	1.34	1.62	5.07	4.99	11	34	55	21	24	55	597	8,955	39,999
60	CD/C	I	I	23	98	121	0.38	1.63	2.02	4.51	4.35	21	31	48	31	22	47	1,419	32,637	139,062
70	C	I	I	31	131	162	0.44	1.87	2.31	4.04	3.81	29	28	43	39	20	41	4,611	142,941	604,041
80	C	MAT	I	37	165	201	0.46	2.06	2.51	3.63	3.34	36	26	38	46	19	35	3,485	128,945	575,025
90	C	MAT	MAT	39	196	236	0.43	2.18	2.62	3.27	2.92	42	24	34	53	17	30	2,504	97,656	490,784
100	C	B	MAT	39	225	264	0.39	2.25	2.64	2.94	2.55	48	22	30	59	16	25	7,867	306,813	1,770,075
110	C	B	MAT	36	250	286	0.33	2.27	2.60	2.65	2.22	53	20	27	64	15	21	12,190	438,840	3,047,500
120	C	B	MAT	32	270	302	0.27	2.25	2.52	2.38	1.91	58	18	24	68	14	18	5,744	183,808	1,550,880
130	C	B	B	27	285	312	0.21	2.19	2.40	2.14	1.63	62	17	21	73	13	14	3,135	84,645	893,475
140	C	B	B	22	296	318	0.16	2.11	2.27	1.91	1.37	66	16	18	77	12	11	3,324	73,128	983,904
150	C	B	B	17	302	319	0.11	2.01	2.13	1.70	1.12	70	14	16	81	11	8	4,673	79,441	1,411,246
160	C	B	B	13	304	317	0.08	1.90	1.98	1.50	0.90	74	13	13	84	10	6	2,655	34,515	807,120
170	C	B	B	10	302	312	0.06	1.78	1.84	1.31	0.68	77	12	11	88	9	3	1,379	13,790	416,458
180	C	B	B	7	297	304	0.04	1.65	1.69	1.14	0.48	80	11	9	90	9	1	778	5,446	231,066
190	C	B	B	5	289	294	0.03	1.52	1.55	0.97	0.29	83	10	7	94	6	0	23	115	6,647
200	C	B	B	4	278	282	0.02	1.39	1.41	0.81	0.15	86	9	5	97	3	0	104	416	28,912

PATHWAY 7: PINE

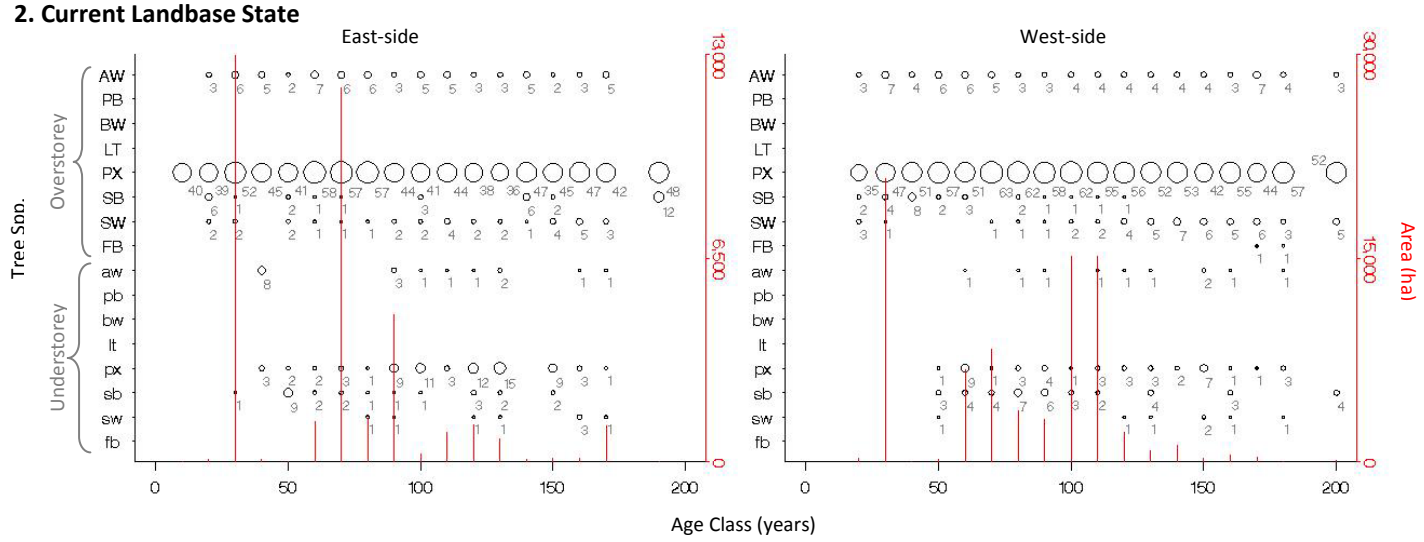
1. AVI Criteria

Pathway 7 is a static based pathway where pine species, black spruce and/or Larch are: 1) greater than 20% of the overstory tree species composition or; 2) greater than 40% of the understorey tree species composition.

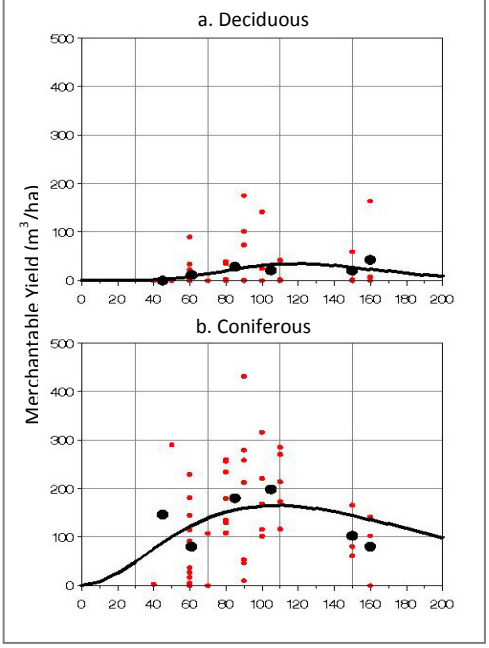
Pathway 7 is separated from other static pathways in that pine species are greater than, or equal to, 80% of the combined overstory and understory.

Note: Refer to Section 9.1 above for graph/table details

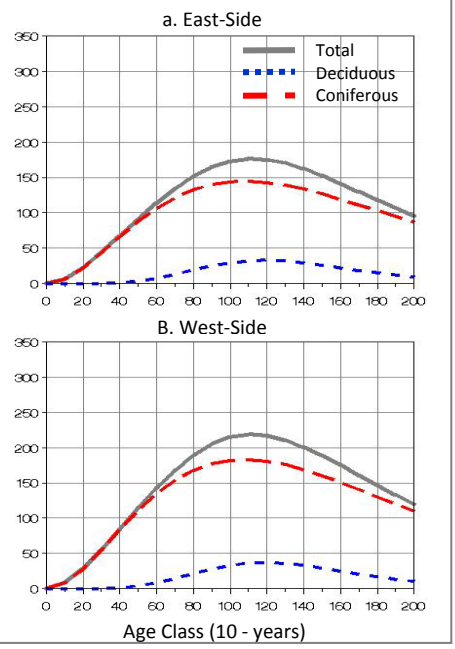
2. Current Landbase State



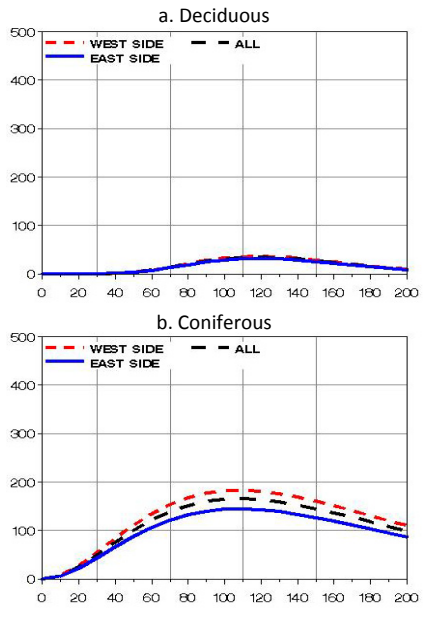
3. Base Yield Models



4. Regionalized Composite Yield



5. Compare East & West Side Models



PATHWAY 7: PINE Cont'd

6. Stand Trajectory

SERAL STAGE (YRS.)	0 -69	70 -109	110-149	150+
COVER-STATE	C	C	C	C

7a. East Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m³/ha)			(5) MAI (m³/ha/yr)			(6) PIECE SIZE (stems/m³)		(7) PIECE SIZE % of merch. vol. (m³) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m³)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	C			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	C	SI	SI	0	6	6	0.00	0.60	0.60	10.14	11.21	0	0	100	0	0	100	381	0	2,286
20	C	SE	SI	0	22	22	0.00	1.10	1.10	8.05	8.93	0	2	98	0	7	93	555	0	12,210
30	C	SE	SE	0	44	44	0.00	1.47	1.47	6.83	7.60	0	15	85	0	24	76	15,902	0	699,688
40	C	I	SE	1	66	67	0.03	1.65	1.68	5.96	6.66	0	25	75	0	36	64	94	94	6,204
50	C	I	SE	3	88	91	0.06	1.76	1.82	5.29	5.93	0	32	68	11	35	54	24	72	2,112
60	C	I	I	7	106	114	0.12	1.77	1.90	4.74	5.33	8	30	62	20	33	47	1,314	9,198	139,284
70	C	I	I	13	121	134	0.19	1.73	1.91	4.27	4.83	16	27	57	28	32	40	13,588	176,644	1,644,148
80	C	MAT	I	19	133	152	0.24	1.66	1.90	3.87	4.39	22	25	53	35	31	34	1,512	28,728	201,096
90	C	MAT	MAT	25	140	165	0.28	1.56	1.83	3.51	4.00	28	23	49	40	30	30	5,546	138,650	776,440
100	C	B	MAT	29	144	173	0.29	1.44	1.73	3.20	3.66	34	21	45	47	28	25	271	7,859	39,024
110	C	B	MAT	32	145	177	0.29	1.32	1.61	2.91	3.34	39	19	42	52	27	21	1,047	33,504	151,815
120	C	B	MAT	33	143	175	0.28	1.19	1.46	2.65	3.06	43	17	40	56	27	17	1,242	40,986	177,606
130	C	B	B	32	139	171	0.25	1.07	1.32	2.40	2.80	47	16	37	60	26	14	814	26,048	113,146
140	C	B	B	29	134	163	0.21	0.96	1.16	2.18	2.55	51	14	35	64	25	11	93	2,697	12,462
150	C	B	B	26	127	153	0.17	0.85	1.02	1.97	2.33	54	13	33	68	24	8	107	2,782	13,589
160	C	B	B	22	119	141	0.14	0.74	0.88	1.78	2.12	57	12	31	71	24	5	126	2,772	14,994
170	C	B	B	18	111	130	0.11	0.65	0.76	1.59	1.92	60	11	29	74	23	3	1,542	27,756	171,162
180	C	B	B	15	103	118	0.08	0.57	0.66	1.42	1.73	63	10	27	77	23	0	0	0	0
190	C	B	B	12	95	107	0.06	0.50	0.56	1.26	1.55	66	9	25	80	20	0	3	36	285
200	C	B	B	9	87	96	0.05	0.44	0.48	1.10	1.38	69	8	23	83	17	0	0	0	0

7b. West Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m³/ha)			(5) MAI (m³/ha/yr)			(6) PIECE SIZE (stems/m³)		(7) PIECE SIZE % of merch. vol. (m³) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m³)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	C			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	C	SI	SI	0	8	8	0.00	0.80	0.80	10.14	11.21	0	0	100	0	0	100	2,512	0	20,096
20	C	SE	SI	0	28	28	0.00	1.40	1.40	8.05	8.93	0	2	98	0	7	93	970	0	27,160
30	C	SE	SE	0	55	55	0.00	1.83	1.83	6.83	7.60	0	15	85	0	24	76	21,874	0	1,203,070
40	C	I	SE	1	84	85	0.03	2.10	2.13	5.96	6.66	0	25	75	0	36	64	253	253	21,252
50	C	I	SE	4	111	115	0.08	2.22	2.30	5.29	5.93	0	32	68	11	35	54	177	708	19,647
60	C	I	I	8	135	143	0.13	2.25	2.38	4.74	5.33	8	30	62	20	33	47	8,660	69,280	1,169,100
70	C	I	I	14	154	168	0.20	2.20	2.40	4.27	4.83	16	27	57	28	32	40	8,503	119,042	1,309,462
80	C	MAT	I	21	168	189	0.26	2.10	2.36	3.87	4.39	22	25	53	35	31	34	3,876	81,396	651,168
90	C	MAT	MAT	28	177	205	0.31	1.97	2.28	3.51	4.00	28	23	49	40	30	30	3,403	95,284	602,331
100	C	B	MAT	33	182	215	0.33	1.82	2.15	3.20	3.66	34	21	45	47	28	25	15,529	512,457	2,826,278
110	C	B	MAT	36	183	219	0.33	1.66	1.99	2.91	3.34	39	19	42	52	27	21	15,935	573,660	2,916,105
120	C	B	MAT	37	181	217	0.31	1.51	1.81	2.65	3.06	43	17	40	56	27	17	2,296	84,952	415,576
130	C	B	B	35	176	211	0.27	1.35	1.62	2.40	2.80	47	16	37	60	26	14	917	32,095	161,392
140	C	B	B	33	169	201	0.24	1.21	1.44	2.18	2.55	51	14	35	64	25	11	1,274	42,042	215,306
150	C	B	B	29	160	189	0.19	1.07	1.26	1.97	2.33	54	13	33	68	24	8	303	8,787	48,480
160	C	B	B	25	151	176	0.16	0.94	1.10	1.78	2.12	57	12	31	71	24	5	712	17,800	107,512
170	C	B	B	20	141	161	0.12	0.83	0.95	1.59	1.92	60	11	29	74	23	3	411	8,220	57,951
180	C	B	B	17	130	147	0.09	0.72	0.82	1.42	1.73	63	10	27	77	23	0	74	1,258	9,620
190	C	B	B	13	120	133	0.07	0.63	0.70	1.26	1.55	66	9	25	80	20	0	0	0	0
200	C	B	B	10	110	120	0.05	0.55	0.60	1.10	1.38	69	8	23	83	17	0	93	930	10,230

PATHWAY 8: PINE-BLACK SPRUCE-DECIDUOUS

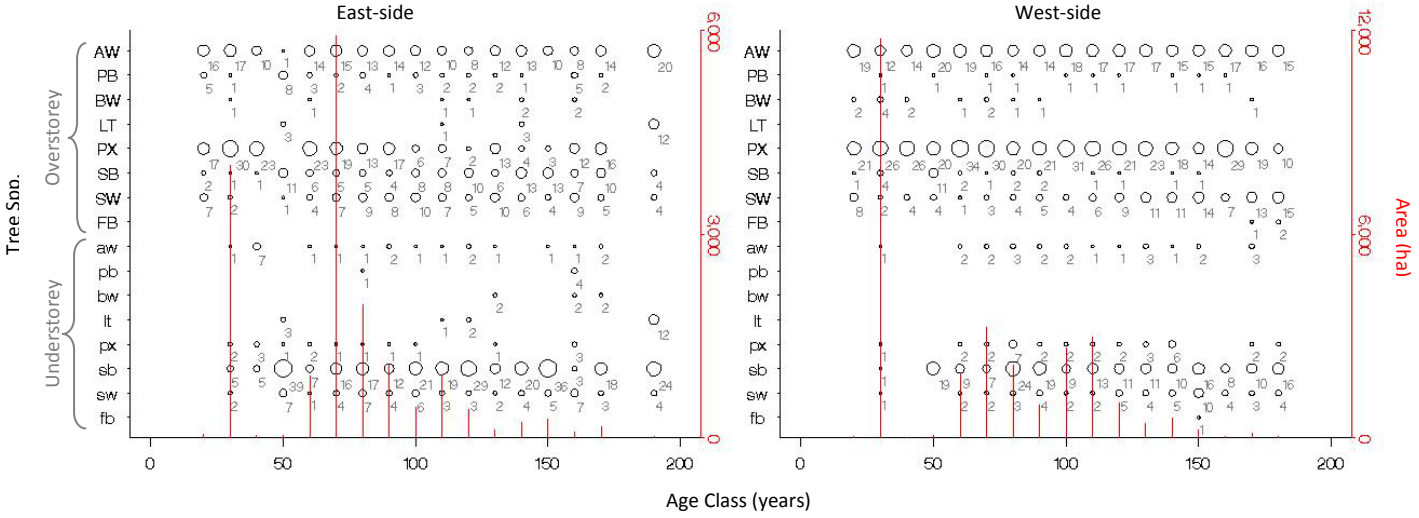
1. AVI Criteria

Pathway 8 is a static based pathway where pine species, black spruce and/or Larch are: 1) greater than 20% of the overstory tree species composition or; 2) greater than 40% of the understorey tree species composition. Pathway 8 is seperated from other static pathways in that conifer tree species are at least 50% of the combined overstorey and understorey while deciduous tree species are at least 30% of the combined overstorey and understorey.

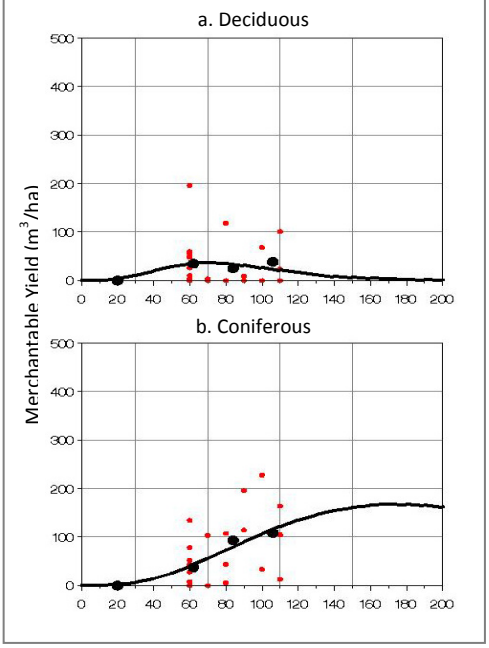
The most common stand types are pine mixed with aspen. Or low density aspen overstories mixed with moderate to high density black spruce understories

Note: Refer to Section 9.1 above for graph/table details

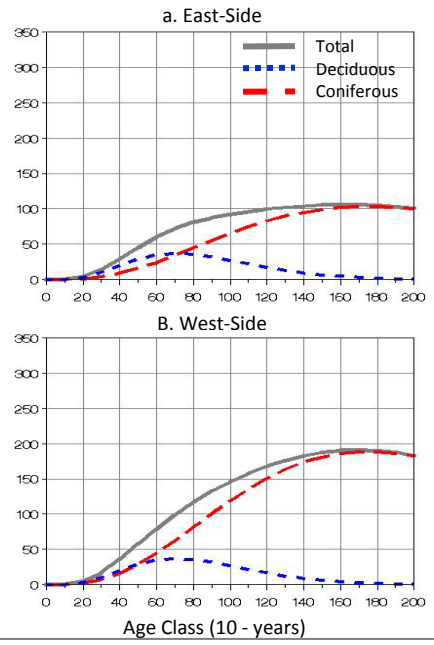
2. Current Landbase State



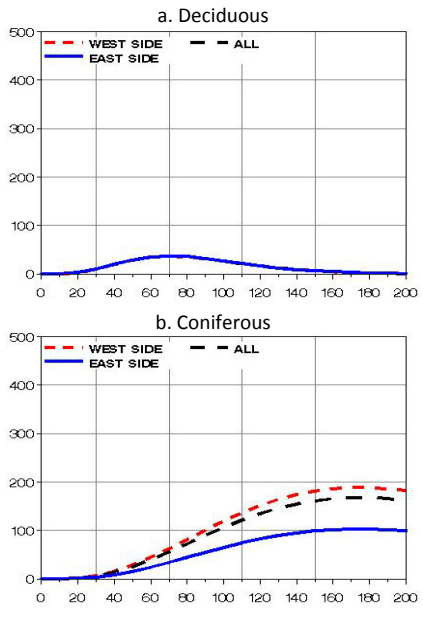
3. Base Yield Models



4. Regionalized Composite Yield



5. Compare East & West Side Models



PATHWAY 8: PINE-BLACK SPRUCE-DECIDUOUS Cont'd

6. Stand Trajectory

SERAL STAGE (YRS.)	0 -69	70 -109	110-149	150+
COVER-STATE	CD	CD	CD	CD

7a. East Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m³/ha)			(5) MAI (m³/ha/yr)			(6) PIECE SIZE (stems/m³)		(7) PIECE SIZE % of merch. vol. (m³) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m³)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	CD			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	CD	SI	SI	0	0	0	0.00	0.00	0.00	11.14	11.56	0	0	100	0	0	100	173	0	0
20	CD	SE	SI	3	1	4	0.15	0.05	0.20	9.35	9.39	0	4	96	0	0	100	122	366	122
30	CD	SE	SE	10	4	14	0.33	0.13	0.47	8.30	8.12	0	17	83	0	15	85	5,101	51,010	20,404
40	CD	I	SE	20	9	29	0.50	0.23	0.73	7.56	7.22	0	27	73	0	26	74	72	1,440	648
50	CD	I	SE	29	16	45	0.58	0.32	0.90	6.98	6.53	0	34	66	0	35	65	63	1,827	1,008
60	CD	I	I	35	24	60	0.58	0.40	1.00	6.51	5.96	8	32	60	8	34	58	1,218	42,630	29,232
70	CD	I	I	37	34	72	0.53	0.49	1.03	6.11	5.47	16	29	55	16	33	51	6,882	254,634	233,988
80	CD	MAT	I	36	45	81	0.45	0.56	1.01	5.77	5.06	23	26	51	22	32	46	2,395	86,220	107,775
90	CD	MAT	MAT	32	55	87	0.36	0.61	0.97	5.47	4.69	29	24	47	28	31	41	1,558	49,856	85,690
100	CD	B	MAT	27	65	92	0.27	0.65	0.92	5.19	4.36	34	23	43	33	30	37	737	19,899	47,905
110	CD	B	MAT	22	75	96	0.20	0.68	0.87	4.95	4.06	39	21	40	37	29	34	1,236	27,192	92,700
120	CD	B	MAT	17	83	100	0.14	0.69	0.83	4.72	3.79	44	19	37	42	28	30	578	9,826	47,974
130	CD	B	B	13	90	102	0.10	0.69	0.78	4.52	3.54	48	17	35	46	27	27	241	3,133	21,690
140	CD	B	B	9	95	104	0.06	0.68	0.74	4.33	3.31	52	16	32	50	26	24	359	3,231	34,105
150	CD	B	B	6	99	106	0.04	0.66	0.71	4.15	3.09	55	15	30	53	26	21	329	1,974	32,571
160	CD	B	B	5	102	106	0.03	0.64	0.66	3.98	2.89	58	14	28	56	25	19	116	580	11,832
170	CD	B	B	3	103	106	0.02	0.61	0.62	3.82	2.70	61	13	26	59	25	16	202	606	20,806
180	CD	B	B	2	103	105	0.01	0.57	0.58	3.68	2.52	64	12	24	62	24	14	0	0	0
190	CD	B	B	1	102	103	0.01	0.54	0.54	3.54	2.35	67	11	22	64	24	12	17	17	1,734
200	CD	B	B	1	100	101	0.01	0.50	0.51	3.40	2.19	70	10	20	67	23	10	0	0	0

7b. West Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m³/ha)			(5) MAI (m³/ha/yr)			(6) PIECE SIZE (stems/m³)		(7) PIECE SIZE % of merch. vol. (m³) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m³)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	CD			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	CD	SI	SI	0	0	0	0.00	0.00	0.00	11.14	11.56	0	0	100	0	0	100	665	0	0
20	CD	SE	SI	3	2	5	0.15	0.10	0.25	9.35	9.39	0	4	96	0	0	100	511	1,533	1,022
30	CD	SE	SE	10	7	17	0.33	0.23	0.57	8.30	8.12	0	17	83	0	15	85	12,676	126,760	88,732
40	CD	I	SE	20	16	36	0.50	0.40	0.90	7.56	7.22	0	27	73	0	26	74	110	2,200	1,760
50	CD	I	SE	29	29	58	0.58	0.58	1.16	6.98	6.53	0	34	66	0	35	65	120	3,480	3,480
60	CD	I	I	35	45	79	0.58	0.75	1.32	6.51	5.96	8	32	60	8	34	58	2,450	85,750	110,250
70	CD	I	I	37	62	99	0.53	0.89	1.41	6.11	5.47	16	29	55	16	33	51	3,528	130,536	218,736
80	CD	MAT	I	35	82	117	0.44	1.03	1.46	5.77	5.06	23	26	51	22	32	46	2,300	80,500	188,600
90	CD	MAT	MAT	32	101	133	0.36	1.12	1.48	5.47	4.69	29	24	47	28	31	41	1,114	35,648	112,514
100	CD	B	MAT	27	119	146	0.27	1.19	1.46	5.19	4.36	34	23	43	33	30	37	2,839	76,653	337,841
110	CD	B	MAT	21	136	158	0.19	1.24	1.44	4.95	4.06	39	21	40	37	29	34	3,251	68,271	442,136
120	CD	B	MAT	17	151	168	0.14	1.26	1.40	4.72	3.79	44	19	37	42	28	30	1,225	20,825	184,975
130	CD	B	B	12	164	176	0.09	1.26	1.35	4.52	3.54	48	17	35	46	27	27	464	5,568	76,096
140	CD	B	B	9	174	183	0.06	1.24	1.31	4.33	3.31	52	16	32	50	26	24	617	5,553	107,358
150	CD	B	B	6	181	188	0.04	1.21	1.25	4.15	3.09	55	15	30	53	26	21	243	1,458	43,983
160	CD	B	B	4	186	191	0.03	1.16	1.19	3.98	2.89	58	14	28	56	25	19	58	232	10,788
170	CD	B	B	3	188	191	0.02	1.11	1.12	3.82	2.70	61	13	26	59	25	16	151	453	28,388
180	CD	B	B	2	188	190	0.01	1.04	1.06	3.68	2.52	64	12	24	62	24	14	58	116	10,904
190	CD	B	B	1	186	188	0.01	0.98	0.99	3.54	2.35	67	11	22	64	24	12	0	0	0
200	CD	B	B	1	183	183	0.01	0.92	0.92	3.40	2.19	70	10	20	67	23	10	0	0	0

PATHWAY 9: DECIDUOUS-PINE-BLACK SPRUCE

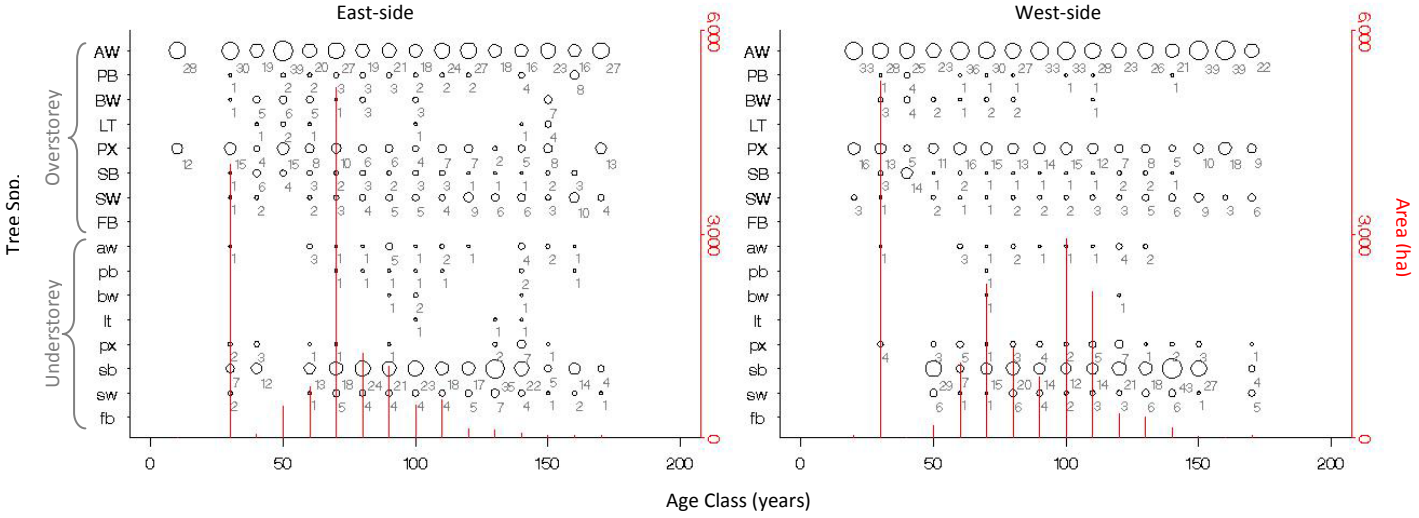
1. AVI Criteria

Pathway 9 is a static based pathway where pine species, black spruce and/or Larch are: 1) greater than 20% of the overstory tree species composition or; 2) greater than 40% of the understorey tree species composition. Pathway 9 is seperated from other static pathways in that deciduous tree species are greater than 50% of the combined overstorey and understorey while conifer tree species are at least 30% of the combined overstorey and understorey.

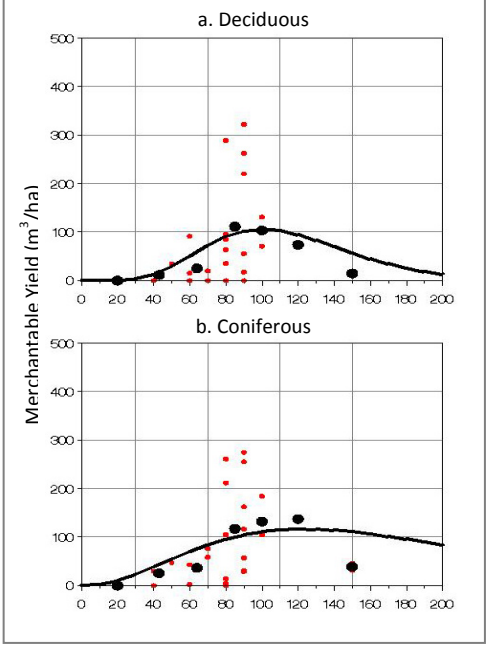
The most common stand types are aspen mixed with pine or high density aspen overstories mixed with low to moderate density black spruce understories.

Note: Refer to Section 9.1 above for graph/table details

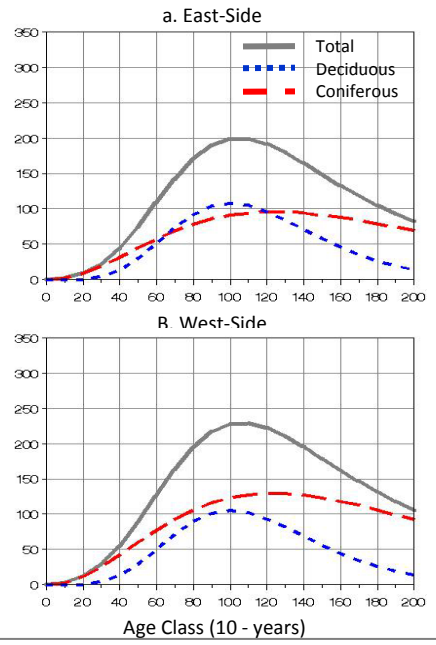
2. Current Landbase State



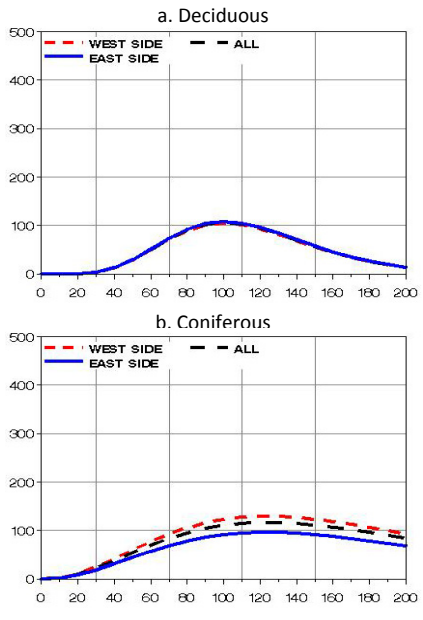
3. Base Yield Models



4. Regionalized Composite Yield



5. Compare East & West Side Models



PATHWAY 9: DECIDUOUS-PINE-BLACK SPRUCE Cont'd

6. Stand Trajectory

SERAL STAGE (YRS.)	0 -69	70 -109	110-149	150+
COVER-STATE	DC	DC	DC	DC

7a. East Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m³/ha)			(5) MAI (m³/ha/yr)			(6) PIECE SIZE (stems/m³)		(7) PIECE SIZE % of merch. vol. (m³) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m³)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	DC			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	DC	SI	SI	0	2	2	0.00	0.20	0.20	10.30	11.17	0	0	100	0	0	100	179	0	358
20	DC	SE	SI	0	8	9	0.00	0.40	0.45	8.26	8.88	0	8	92	0	0	100	2	0	16
30	DC	SE	SE	4	19	22	0.13	0.63	0.73	7.07	7.55	0	22	78	0	16	84	5,276	21,104	100,244
40	DC	I	SE	13	31	44	0.33	0.78	1.10	6.22	6.60	0	32	68	0	28	72	171	2,223	5,301
50	DC	I	SE	30	45	74	0.60	0.90	1.48	5.56	5.86	2	37	61	9	28	63	616	18,480	27,720
60	DC	I	I	51	57	109	0.85	0.95	1.82	5.03	5.26	12	34	54	18	26	56	1,344	68,544	76,608
70	DC	I	I	74	69	142	1.06	0.99	2.03	4.57	4.75	20	31	49	25	25	50	6,123	453,102	422,487
80	DC	MAT	I	92	78	171	1.15	0.98	2.14	4.18	4.31	27	29	44	32	23	45	1,478	135,976	115,284
90	DC	MAT	MAT	104	86	190	1.16	0.96	2.11	3.83	3.92	33	27	40	38	22	40	1,229	127,816	105,694
100	DC	B	MAT	108	91	199	1.08	0.91	1.99	3.52	3.58	38	25	37	43	21	36	514	55,512	46,774
110	DC	B	MAT	105	94	199	0.95	0.85	1.81	3.24	3.26	43	24	33	48	20	32	636	66,780	59,784
120	DC	B	MAT	96	96	192	0.80	0.80	1.60	2.98	2.98	48	22	30	53	19	28	135	12,960	12,960
130	DC	B	B	84	96	180	0.65	0.74	1.38	2.75	2.71	52	20	28	57	18	25	112	9,408	10,752
140	DC	B	B	71	94	165	0.51	0.67	1.18	2.53	2.47	56	19	25	61	17	22	96	6,816	9,024
150	DC	B	B	58	91	149	0.39	0.61	0.99	2.33	2.24	59	18	23	64	17	19	67	3,886	6,097
160	DC	B	B	46	88	133	0.29	0.55	0.83	2.14	2.03	62	17	21	68	15	17	31	1,426	2,728
170	DC	B	B	35	84	119	0.21	0.49	0.70	1.96	1.83	65	16	19	71	15	14	46	1,610	3,864
180	DC	B	B	26	79	105	0.14	0.44	0.58	1.79	1.64	68	15	17	74	14	12	4	104	316
190	DC	B	B	19	74	93	0.10	0.39	0.49	1.63	1.46	71	14	15	76	14	10	0	0	0
200	DC	B	B	14	69	83	0.07	0.35	0.42	1.48	1.29	74	13	13	79	13	8	12	168	828

7b. West Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m³/ha)			(5) MAI (m³/ha/yr)			(6) PIECE SIZE (stems/m³)		(7) PIECE SIZE % of merch. vol. (m³) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m³)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	DC			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	DC	SI	SI	0	2	3	0.00	0.20	0.30	10.30	11.17	0	0	100	0	0	100	209	0	418
20	DC	SE	SI	0	11	12	0.00	0.55	0.60	8.26	8.88	0	8	92	0	0	100	354	0	3,894
30	DC	SE	SE	4	25	29	0.13	0.83	0.97	7.07	7.55	0	22	78	0	16	84	6,966	27,864	174,150
40	DC	I	SE	13	42	55	0.33	1.05	1.38	6.22	6.60	0	32	68	0	28	72	88	1,144	3,696
50	DC	I	SE	29	60	89	0.58	1.20	1.78	5.56	5.86	2	37	61	9	28	63	221	6,409	13,260
60	DC	I	I	50	77	127	0.83	1.28	2.12	5.03	5.26	12	34	54	18	26	56	1,301	65,050	100,177
70	DC	I	I	72	93	164	1.03	1.33	2.34	4.57	4.75	20	31	49	25	25	50	2,645	190,440	245,985
80	DC	MAT	I	90	106	195	1.13	1.33	2.44	4.18	4.31	27	29	44	32	23	45	1,499	134,910	158,894
90	DC	MAT	MAT	101	116	217	1.12	1.29	2.41	3.83	3.92	33	27	40	38	22	40	973	98,273	112,868
100	DC	B	MAT	105	123	228	1.05	1.23	2.28	3.52	3.58	38	25	37	43	21	36	2,979	312,795	366,417
110	DC	B	MAT	102	127	229	0.93	1.15	2.08	3.24	3.26	43	24	33	48	20	32	2,343	238,986	297,561
120	DC	B	MAT	93	129	223	0.78	1.08	1.86	2.98	2.98	48	22	30	53	19	28	383	35,619	49,407
130	DC	B	B	82	129	211	0.63	0.99	1.62	2.75	2.71	52	20	28	57	18	25	325	26,650	41,925
140	DC	B	B	69	127	196	0.49	0.91	1.40	2.53	2.47	56	19	25	61	17	22	164	11,316	20,828
150	DC	B	B	56	123	179	0.37	0.82	1.19	2.33	2.24	59	18	23	64	17	19	36	2,016	4,428
160	DC	B	B	44	118	163	0.28	0.74	1.02	2.14	2.03	62	17	21	68	15	17	19	836	2,242
170	DC	B	B	34	113	147	0.20	0.66	0.86	1.96	1.83	65	16	19	71	15	14	42	1,428	4,746
180	DC	B	B	26	106	132	0.14	0.59	0.73	1.79	1.64	68	15	17	74	14	12	0	0	0
190	DC	B	B	19	99	118	0.10	0.52	0.62	1.63	1.46	71	14	15	76	14	10	0	0	0
200	DC	B	B	14	92	106	0.07	0.46	0.53	1.48	1.29	74	13	13	79	13	8	0	0	0

PATHWAY 10: PINE-WHITE SPRUCE

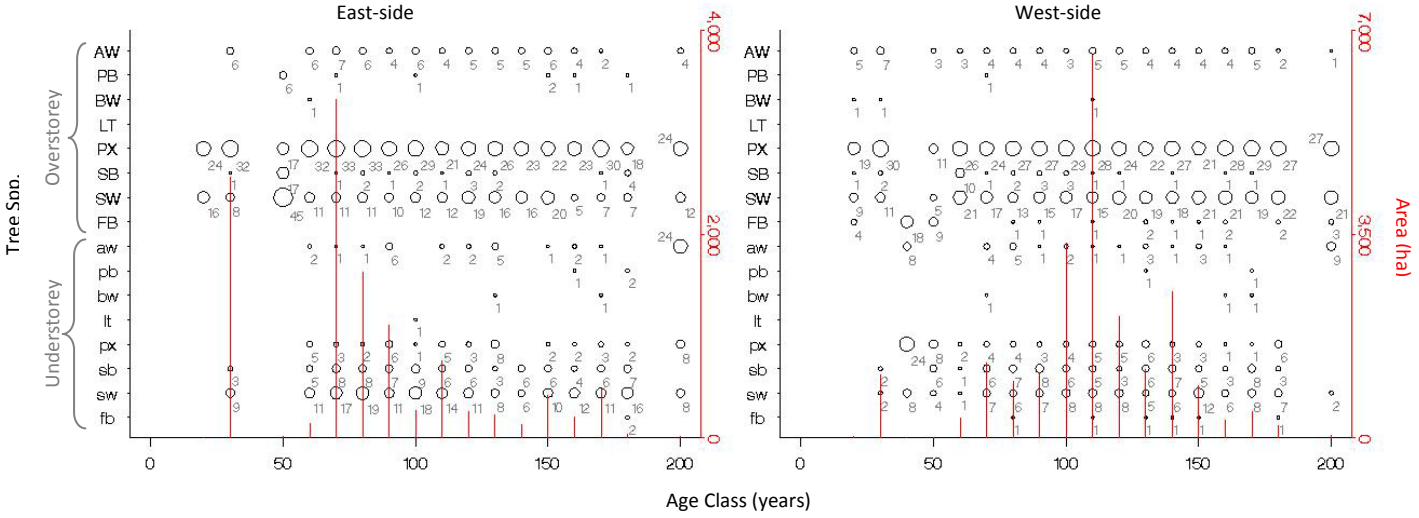
1. AVI Criteria

Pathway 10 is a static based pathway where pine species, black spruce and/or Larch are: 1) greater than 20% of the overstory tree species composition or; 2) greater than 40% of the understorey tree species composition.

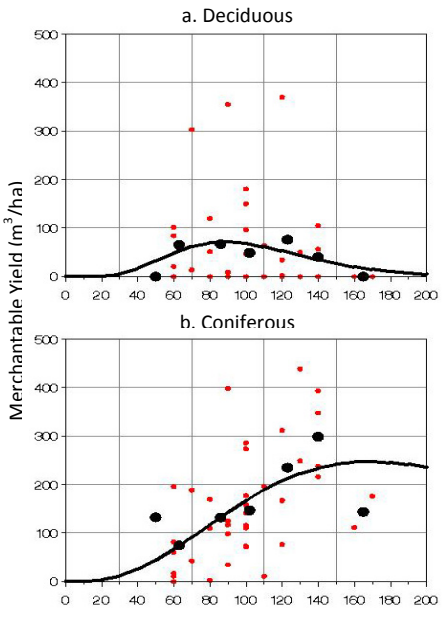
Pathway 10 is separated from other static pathways in that it is a 'C' coverstate and white spruce and/or fir are greater than or equal to 20% of the combined overstorey and understorey composition and pine species are greater than or equal to black spruce and/or larch in the combined overstorey and understorey composition.

Note: Refer to Section 9.1 above for graph/table details

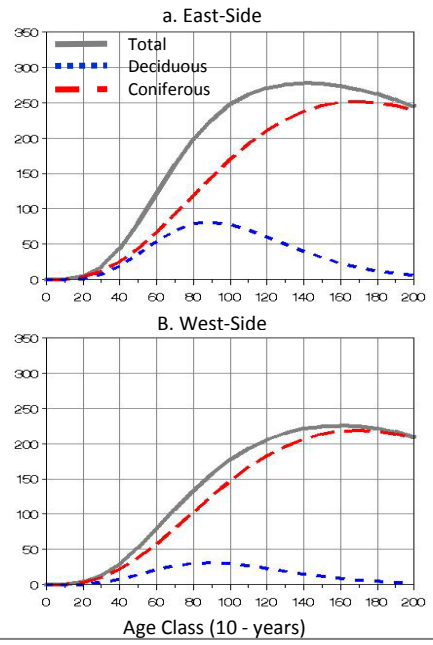
2. Current Landbase State



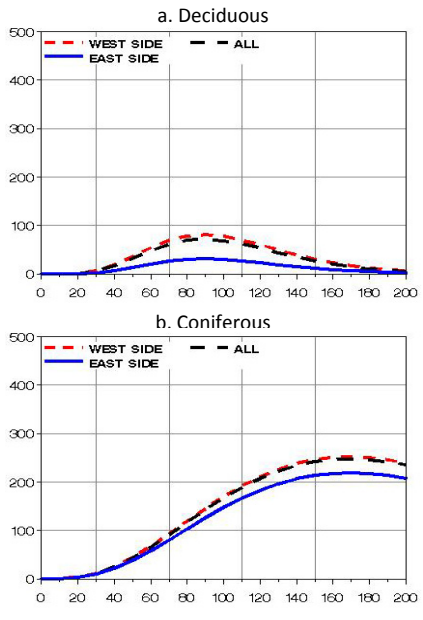
3. Base Yield Models



4. Regionalized Composite Yield



5. Compare East & West Side Models



PATHWAY 10: PINE-WHIT SPRUCE Cont'd

6. Stand Trajectory

SERAL STAGE (YRS.)	0 -69	70 -109	110-149	150+
COVER-STATE	C	C	C	C

7a. East Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m³/ha)			(5) MAI (m³/ha/yr)			(6) PIECE SIZE (stems/m³)		(7) PIECE SIZE % of merch. vol. (m³) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m³)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	C			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	C	SI	SI	0	0	0	0.00	0.00	0.00	9.97	11.31	0	0	100	0	0	100	147	0	0
20	C	SE	SI	0	3	4	0.00	0.15	0.20	7.83	9.06	0	14	86	0	1	99	8	0	24
30	C	SE	SE	3	10	13	0.10	0.33	0.43	6.58	7.75	0	29	71	0	17	83	2,900	8,700	29,000
40	C	I	SE	7	22	29	0.18	0.55	0.73	5.69	6.82	0	40	60	0	29	71	0	0	0
50	C	I	SE	14	38	52	0.28	0.76	1.04	5.00	6.10	9	39	52	2	36	62	11	154	418
60	C	I	I	21	58	79	0.35	0.97	1.32	4.44	5.51	18	36	46	11	34	55	161	3,381	9,338
70	C	I	I	27	80	107	0.39	1.14	1.53	3.96	5.01	27	33	40	19	33	48	3,450	93,150	276,000
80	C	MAT	I	30	103	133	0.38	1.29	1.66	3.55	4.58	34	31	35	26	31	43	1,719	51,570	177,057
90	C	MAT	MAT	31	126	157	0.34	1.40	1.74	3.19	4.20	40	29	31	32	30	38	1,248	38,688	157,248
100	C	B	MAT	30	147	177	0.30	1.47	1.77	2.86	3.85	46	27	27	37	29	34	280	8,400	41,160
110	C	B	MAT	27	167	193	0.25	1.52	1.75	2.57	3.55	51	26	23	42	28	30	773	20,871	129,091
120	C	B	MAT	23	183	206	0.19	1.53	1.72	2.30	3.27	56	24	20	46	27	27	266	6,118	48,678
130	C	B	B	19	196	215	0.15	1.51	1.65	2.05	3.01	60	23	17	50	27	23	237	4,503	46,452
140	C	B	B	15	207	222	0.11	1.48	1.59	1.82	2.77	64	21	15	54	26	20	140	2,100	28,980
150	C	B	B	12	214	225	0.08	1.43	1.50	1.61	2.54	68	20	12	57	25	18	454	5,448	97,156
160	C	B	B	9	218	226	0.06	1.36	1.41	1.41	2.33	71	19	10	60	25	15	203	1,827	44,254
170	C	B	B	6	219	225	0.04	1.29	1.32	1.22	2.14	74	18	8	63	24	13	708	4,248	155,052
180	C	B	B	5	217	222	0.03	1.21	1.23	1.04	1.95	77	17	6	66	24	10	38	190	8,246
190	C	B	B	3	214	217	0.02	1.13	1.14	0.88	1.78	80	16	4	69	23	8	0	0	0
200	C	B	B	2	208	210	0.01	1.04	1.05	0.72	1.61	83	15	2	71	23	6	12	24	2,496

7b. West Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m³/ha)			(5) MAI (m³/ha/yr)			(6) PIECE SIZE (stems/m³)		(7) PIECE SIZE % of merch. vol. (m³) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m³)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	C			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	C	SI	SI	0	0	0	0.00	0.00	0.00	9.97	11.31	0	0	100	0	0	100	1,241	0	0
20	C	SE	SI	1	4	5	0.05	0.20	0.25	7.83	9.06	0	14	86	0	1	99	392	392	1,568
30	C	SE	SE	7	12	18	0.23	0.40	0.60	6.58	7.75	0	29	71	0	17	83	1,189	8,323	14,268
40	C	I	SE	19	25	44	0.48	0.63	1.10	5.69	6.82	0	40	60	0	29	71	124	2,356	3,100
50	C	I	SE	36	44	80	0.72	0.88	1.60	5.00	6.10	9	39	52	2	36	62	18	648	792
60	C	I	I	54	67	121	0.90	1.12	2.02	4.44	5.51	18	36	46	11	34	55	368	19,872	24,656
70	C	I	I	69	93	162	0.99	1.33	2.31	3.96	5.01	27	33	40	19	33	48	1,330	91,770	123,690
80	C	MAT	I	79	119	198	0.99	1.49	2.48	3.55	4.58	34	31	35	26	31	43	997	78,763	118,643
90	C	MAT	MAT	81	145	226	0.90	1.61	2.51	3.19	4.20	40	29	31	32	30	38	1,204	97,524	174,580
100	C	B	MAT	78	170	248	0.78	1.70	2.48	2.86	3.85	46	27	27	37	29	34	3,659	285,402	622,030
110	C	B	MAT	70	192	262	0.64	1.75	2.38	2.57	3.55	51	26	23	42	28	30	6,998	489,860	1,343,616
120	C	B	MAT	60	211	271	0.50	1.76	2.26	2.30	3.27	56	24	20	46	27	27	2,267	136,020	478,337
130	C	B	B	50	226	276	0.38	1.74	2.12	2.05	3.01	60	23	17	50	27	23	1,287	64,350	290,862
140	C	B	B	40	238	278	0.29	1.70	1.99	1.82	2.77	64	21	15	54	26	20	2,641	105,640	628,558
150	C	B	B	31	246	277	0.21	1.64	1.85	1.61	2.54	68	20	12	57	25	18	1,007	31,217	247,722
160	C	B	B	23	251	274	0.14	1.57	1.71	1.41	2.33	71	19	10	60	25	15	414	9,522	103,914
170	C	B	B	17	252	269	0.10	1.48	1.58	1.22	2.14	74	18	8	63	24	13	506	8,602	127,512
180	C	B	B	12	250	263	0.07	1.39	1.46	1.04	1.95	77	17	6	66	24	10	220	2,640	55,000
190	C	B	B	9	246	255	0.05	1.29	1.34	0.88	1.78	80	16	4	69	23	8	6	54	1,476
200	C	B	B	6	240	246	0.03	1.20	1.23	0.72	1.61	83	15	2	71	23	6	49	294	11,760

PATHWAY 11: BALSAM POPLAR>>SHRUB

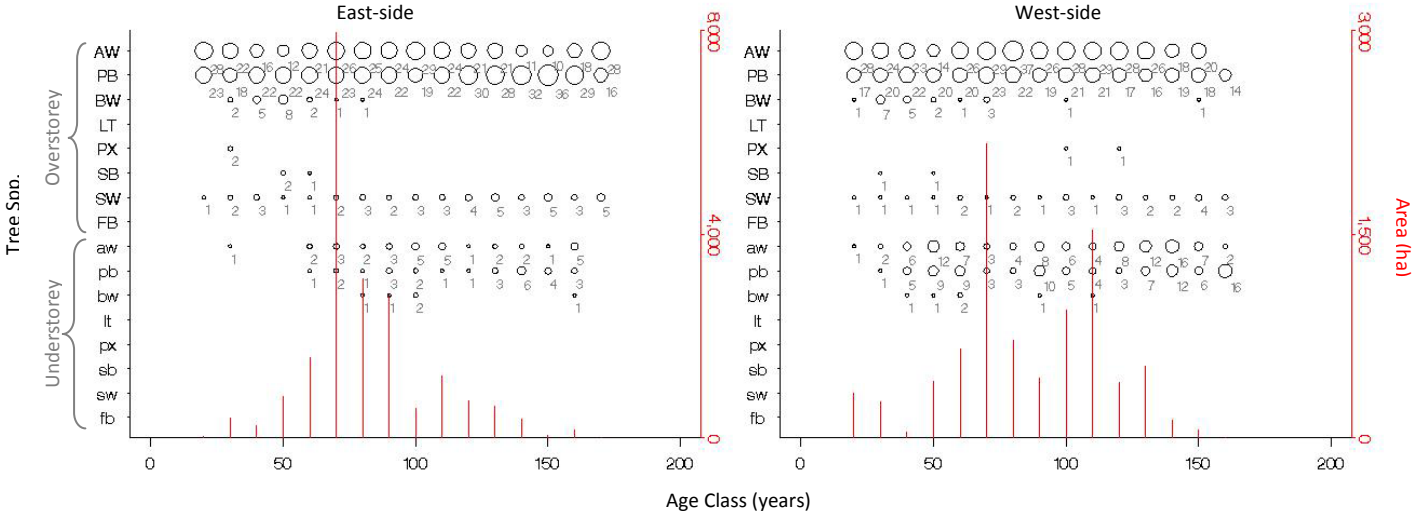
1. AVI Criteria

Pathway 11 is a succession based pathway where pine species, black spruce and/or Larch are: 1) less than or equal to 20% of the overstory tree species composition and; 2) less than or equal to 40% of the understorey tree species composition.

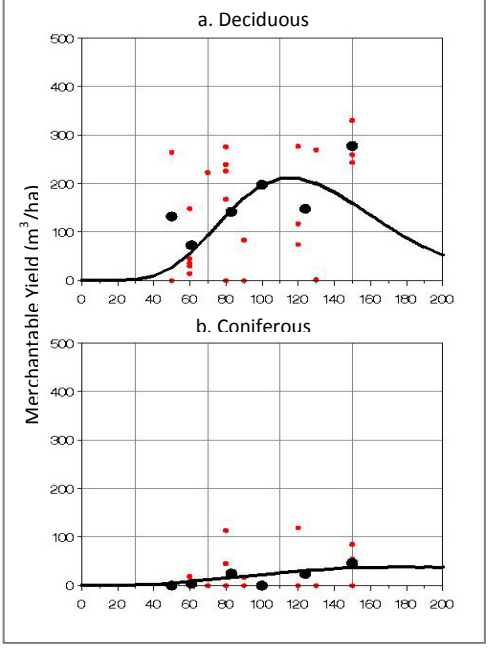
Pathway 11 is the same as Pathway 1 except that balsam poplar is the leading tree species.

Note: Refer to Section 9.1 above for graph/table details

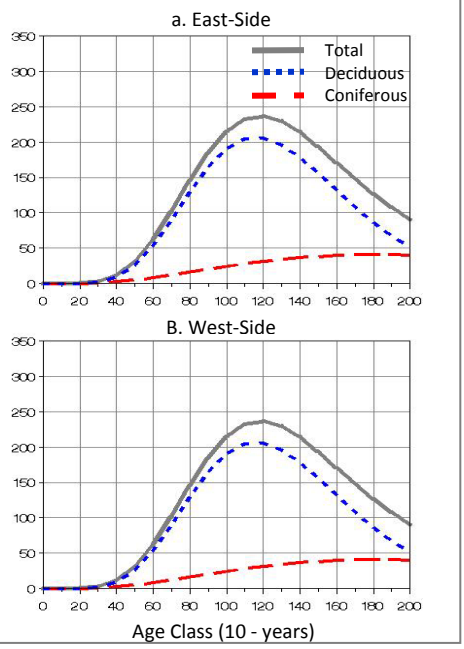
2. Current Landbase State



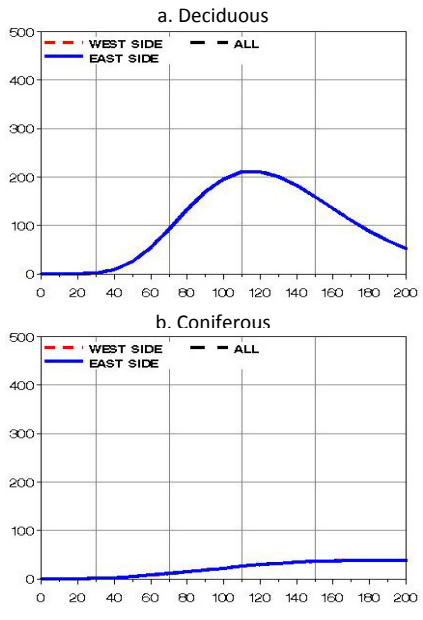
3. Base Yield Models



4. Regionalized Composite Yield



5. Compare East & West Side Models



PATHWAY 11: BALSAM POPLAR>>SHRUB Cont'd

6. Stand Trajectory

SERAL STAGE (YRS.)	0 -69	70 -109	110-149	150+
COVER-STATE	D	D	D	D-Shrub

7a. East Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m³/ha)			(5) MAI (m³/ha/yr)			(6) PIECE SIZE (stems/m³)		(7) PIECE SIZE % of merch. vol. (m³) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m³)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	D			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	D	SI	SI	0	0	0	0.00	0.00	0.00	9.69	10.81	0	0	100	0	0	100	812	0	0
20	D	SE	SI	0	0	1	0.00	0.00	0.05	7.46	8.42	0	19	81	0	1	99	296	0	0
30	D	SE	SE	2	1	3	0.07	0.03	0.10	6.16	7.02	0	34	66	0	17	83	1,524	3,048	1,524
40	D	I	SE	9	3	12	0.23	0.08	0.30	5.24	6.03	8	37	55	5	23	72	623	5,607	1,869
50	D	I	SE	26	5	31	0.52	0.10	0.62	4.52	5.26	21	33	46	17	20	63	2,851	74,126	14,255
60	D	I	I	54	8	62	0.90	0.13	1.03	3.94	4.63	31	29	40	27	18	55	3,959	213,786	31,672
70	D	I	I	90	12	102	1.29	0.17	1.46	3.44	4.10	40	26	34	35	16	49	14,077	1,266,930	168,924
80	D	MAT	I	130	16	146	1.63	0.20	1.83	3.01	3.64	47	24	29	42	14	44	5,894	766,220	94,304
90	D	MAT	MAT	165	20	185	1.83	0.22	2.06	2.63	3.23	54	22	24	49	12	39	5,031	830,115	100,620
100	D	B	MAT	191	24	215	1.91	0.24	2.15	2.30	2.87	60	20	20	54	11	35	1,148	219,268	27,552
110	D	B	MAT	205	28	233	1.86	0.25	2.12	1.99	2.54	65	18	17	59	10	31	2,395	490,975	67,060
120	D	B	MAT	206	31	237	1.72	0.26	1.98	1.71	2.24	71	16	13	64	9	27	997	205,382	30,907
130	D	B	B	196	34	230	1.51	0.26	1.77	1.45	1.96	75	15	10	68	8	24	780	152,880	26,520
140	D	B	B	178	37	215	1.27	0.26	1.54	1.22	1.71	79	13	8	72	7	21	474	84,372	17,538
150	D	B	B	156	38	194	1.04	0.25	1.29	0.99	1.47	83	12	5	76	6	18	86	13,416	3,268
160	D	B	B	132	40	171	0.83	0.25	1.07	0.79	1.25	87	11	2	79	5	16	304	40,128	12,160
170	D	B	B	108	41	149	0.64	0.24	0.88	0.59	1.04	90	10	0	83	4	13	47	5,076	1,927
180	D	B	B	86	41	127	0.48	0.23	0.71	0.41	0.84	94	6	0	86	3	11	0	0	0
190	D	B	B	67	41	108	0.35	0.22	0.57	0.23	0.65	97	3	0	88	3	9	0	0	0
200	D	B	B	51	40	91	0.26	0.20	0.46	0.15	0.48	100	0	0	91	2	7	0	0	0

7b. West Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m³/ha)			(5) MAI (m³/ha/yr)			(6) PIECE SIZE (stems/m³)		(7) PIECE SIZE % of merch. vol. (m³) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m³)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	D			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	D	SI	SI	0	0	0	0.00	0.00	0.00	9.69	10.81	0	0	100	0	0	100	646	0	0
20	D	SE	SI	0	0	1	0.00	0.00	0.05	7.46	8.42	0	19	81	0	1	99	3,336	0	0
30	D	SE	SE	2	1	3	0.07	0.03	0.10	6.16	7.02	0	34	66	0	17	83	1,182	2,364	1,182
40	D	I	SE	9	3	12	0.23	0.08	0.30	5.24	6.03	8	37	55	5	23	72	404	3,636	1,212
50	D	I	SE	26	5	31	0.52	0.10	0.62	4.52	5.26	21	33	46	17	20	63	841	21,866	4,205
60	D	I	I	54	8	62	0.90	0.13	1.03	3.94	4.63	31	29	40	27	18	55	1,469	79,326	11,752
70	D	I	I	90	12	102	1.29	0.17	1.46	3.44	4.10	40	26	34	35	16	49	3,141	282,690	37,692
80	D	MAT	I	130	16	146	1.63	0.20	1.83	3.01	3.64	47	24	29	42	14	44	1,064	138,320	17,024
90	D	MAT	MAT	165	20	185	1.83	0.22	2.06	2.63	3.23	54	22	24	49	12	39	969	159,885	19,380
100	D	B	MAT	191	24	215	1.91	0.24	2.15	2.30	2.87	60	20	20	54	11	35	1,284	245,244	30,816
110	D	B	MAT	205	28	233	1.86	0.25	2.12	1.99	2.54	65	18	17	59	10	31	2,371	486,055	66,388
120	D	B	MAT	206	31	237	1.72	0.26	1.98	1.71	2.24	71	16	13	64	9	27	468	96,408	14,508
130	D	B	B	196	34	230	1.51	0.26	1.77	1.45	1.96	75	15	10	68	8	24	585	114,660	19,890
140	D	B	B	178	37	215	1.27	0.26	1.54	1.22	1.71	79	13	8	72	7	21	151	26,878	5,587
150	D	B	B	156	38	194	1.04	0.25	1.29	0.99	1.47	83	12	5	76	6	18	93	14,508	3,534
160	D	B	B	132	40	171	0.83	0.25	1.07	0.79	1.25	87	11	2	79	5	16	3	396	120
170	D	B	B	108	41	149	0.64	0.24	0.88	0.59	1.04	90	10	0	83	4	13	0	0	0
180	D	B	B	86	41	127	0.48	0.23	0.71	0.41	0.84	94	6	0	86	3	11	0	0	0
190	D	B	B	67	41	108	0.35	0.22	0.57	0.23	0.65	97	3	0	88	3	9	0	0	0
200	D	B	B	51	40	91	0.26	0.20	0.46	0.15	0.48	100	0	0	91	2	7	0	0	0

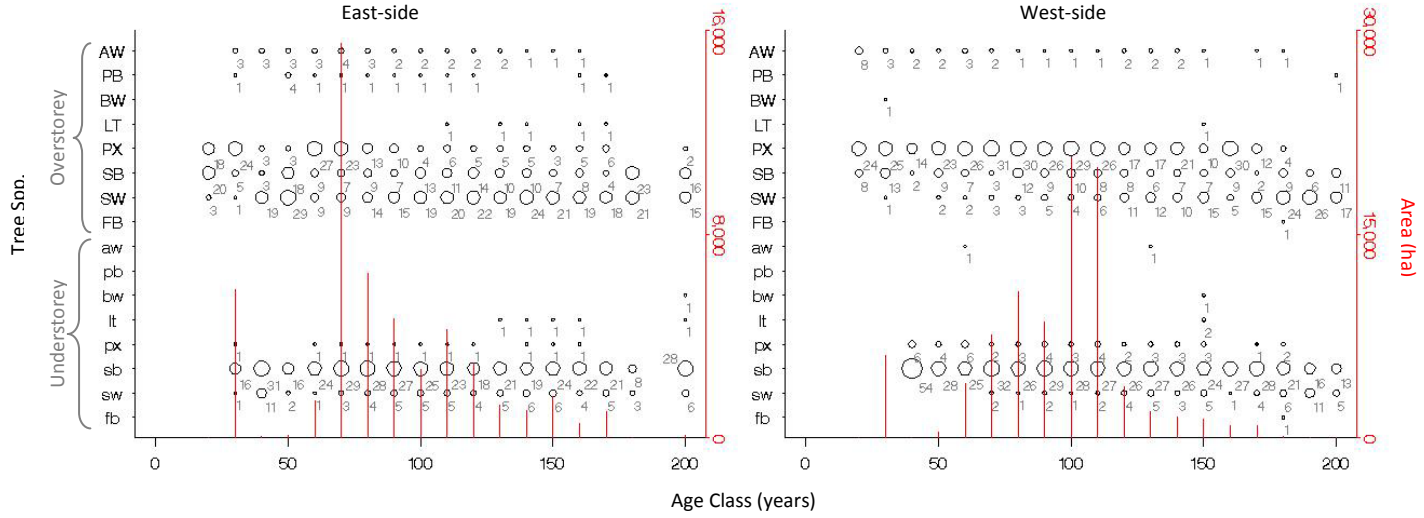
PATHWAY 12: BLACK SPRUCE-PINE/WHITE SPRUCE

1. AVI Criteria

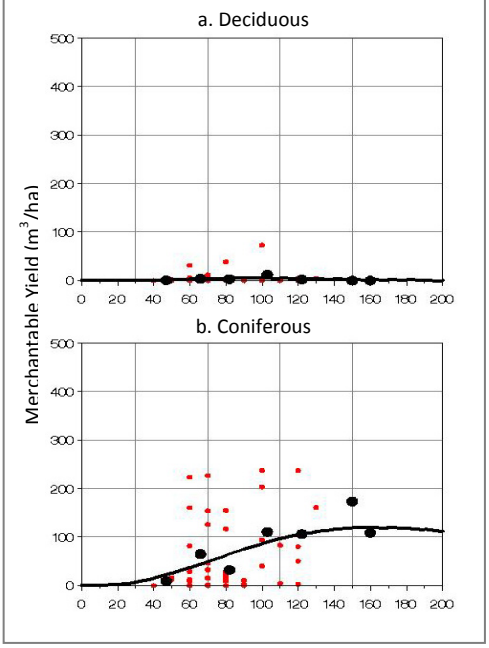
Pathway 12 is a static based pathway where pine species, black spruce and/or Larch are: 1) greater than 20% of the overstory tree species composition or; 2) greater than 40% of the understorey tree species composition. Pathway 12 is defined by two stand types: 1) black spruce-pine or 2) black spruce-white spruce. It is separated from other static pathways in that it is a 'C' coverstate with less than 20% white spruce and/or fir in the combined overstorey and understorey *or* with greater than or equal to 20% white spruce and/or fir *if* pine species are less than black spruce and/or larch in the combined overstorey and understorey.

Note: Refer to Section 9.1 above for graph/table details

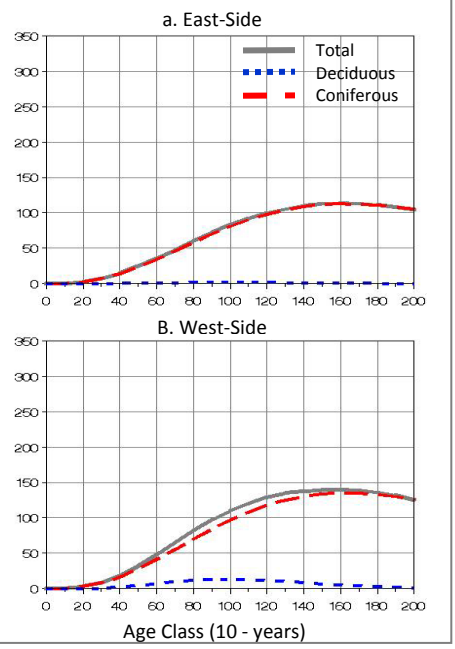
2. Current Landbase State



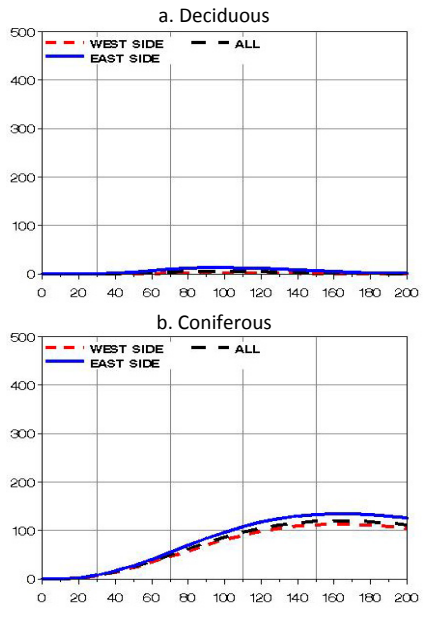
3. Base Yield Models



4. Regionalized Composite Yield



5. Compare East & West Side Models



PATHWAY 12: BLACK SPRUCE-PINE/WHITE SPRUCE Cont'd

6. Stand Trajectory

SERAL STAGE (YRS.)	0 -69	70 -109	110-149	150+
COVER-STATE	C	C	C	C

7a. East Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m^3/ha)			(5) MAI (m^3/ha/yr)			(6) PIECE SIZE (stems/m^3)		(7) PIECE SIZE % of merch. vol. (m^3) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m^3)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	C			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	C	SI	SI	0	0	0	0.00	0.00	0.00	10.81	11.83	0	0	100	0	0	100	566	0	0
20	C	SE	SI	0	3	3	0.00	0.15	0.15	8.93	9.75	0	0	100	0	0	100	50	0	150
30	C	SE	SE	0	8	8	0.00	0.27	0.27	7.82	8.53	0	0	100	0	0	100	12,228	0	97,824
40	C	I	SE	2	16	18	0.05	0.40	0.45	7.04	7.66	0	10	90	0	10	90	51	102	816
50	C	I	SE	4	28	32	0.08	0.56	0.64	6.43	6.99	0	18	82	0	18	82	168	672	4,704
60	C	I	I	7	41	48	0.12	0.68	0.80	5.94	6.44	0	24	76	0	24	76	1,641	11,487	67,281
70	C	I	I	10	55	65	0.14	0.79	0.93	5.52	5.98	5	25	70	5	25	70	16,479	164,790	906,345
80	C	MAT	I	12	70	82	0.15	0.88	1.03	5.15	5.58	10	24	66	10	24	66	7,028	84,336	491,960
90	C	MAT	MAT	13	84	97	0.14	0.93	1.08	4.83	5.22	16	23	61	16	23	61	5,123	66,599	430,332
100	C	B	MAT	13	97	110	0.13	0.97	1.10	4.54	4.91	21	21	58	21	21	58	2,972	38,636	288,284
110	C	B	MAT	12	108	120	0.11	0.98	1.09	4.28	4.62	25	20	55	25	20	55	4,647	55,764	501,876
120	C	B	MAT	11	118	129	0.09	0.98	1.08	4.05	4.36	29	20	51	29	20	51	3,193	35,123	376,774
130	C	B	B	10	125	135	0.08	0.96	1.04	3.83	4.12	33	19	48	33	19	48	1,543	15,430	192,875
140	C	B	B	8	130	138	0.06	0.93	0.99	3.63	3.90	36	18	46	36	18	46	1,179	9,432	153,270
150	C	B	B	6	134	140	0.04	0.89	0.93	3.44	3.69	39	17	44	39	17	44	1,842	11,052	246,828
160	C	B	B	5	135	140	0.03	0.84	0.88	3.26	3.49	42	17	41	42	17	41	651	3,255	87,885
170	C	B	B	4	135	139	0.02	0.79	0.82	3.10	3.31	45	16	39	45	16	39	1,160	4,640	156,600
180	C	B	B	3	133	136	0.02	0.74	0.76	2.94	3.14	48	15	37	48	15	37	38	114	5,054
190	C	B	B	2	130	132	0.01	0.68	0.69	2.80	2.98	50	15	35	50	15	35	0	0	0
200	C	B	B	1	125	126	0.01	0.63	0.63	2.66	2.82	53	14	33	53	14	33	86	86	10,750

7b. West Side Yield and Piece Size Table

(1) AGE (years)	(2) BCT	(3) MC		(4) YIELD (m^3/ha)			(5) MAI (m^3/ha/yr)			(6) PIECE SIZE (stems/m^3)		(7) PIECE SIZE % of merch. vol. (m^3) by tree						(8) LAND-BASE AREA (ha)	(9) STANDING MERCH. CROP (m^3)	
												Dec.			Con.					
		Dec.	Con.	Dec.	Con.	Tot.	Dec.	Con.	Tot.	Dec.	Con.	L	M	S	L	M	S		Dec.	Con.
0	C			0	0	0	0.00	0.00	0.00	17.09	18.76	0	0	100	0	0	100	0	0	0
10	C	SI	SI	0	0	0	0.00	0.00	0.00	10.81	11.83	0	0	100	0	0	100	1,455	0	0
20	C	SE	SI	0	2	2	0.00	0.10	0.10	8.93	9.75	0	0	100	0	0	100	139	0	278
30	C	SE	SE	0	7	7	0.00	0.23	0.23	7.82	8.53	0	0	100	0	0	100	7,329	0	51,303
40	C	I	SE	0	14	14	0.00	0.35	0.35	7.04	7.66	0	10	90	0	10	90	48	0	672
50	C	I	SE	1	23	24	0.02	0.46	0.48	6.43	6.99	0	18	82	0	18	82	449	449	10,327
60	C	I	I	1	34	35	0.02	0.57	0.58	5.94	6.44	0	24	76	0	24	76	5,235	5,235	177,990
70	C	I	I	1	46	47	0.01	0.66	0.67	5.52	5.98	5	25	70	5	25	70	7,778	7,778	357,788
80	C	MAT	I	2	58	60	0.03	0.73	0.75	5.15	5.58	10	24	66	10	24	66	11,248	22,496	652,384
90	C	MAT	MAT	2	70	72	0.02	0.78	0.80	4.83	5.22	16	23	61	16	23	61	9,072	18,144	635,040
100	C	B	MAT	2	81	83	0.02	0.81	0.83	4.54	4.91	21	21	58	21	21	58	21,735	43,470	1,760,535
110	C	B	MAT	2	90	92	0.02	0.82	0.84	4.28	4.62	25	20	55	25	20	55	21,162	42,324	1,904,580
120	C	B	MAT	2	98	100	0.02	0.82	0.83	4.05	4.36	29	20	51	29	20	51	4,063	8,126	398,174
130	C	B	B	1	104	105	0.01	0.80	0.81	3.83	4.12	33	19	48	33	19	48	2,188	2,188	227,552
140	C	B	B	1	109	110	0.01	0.78	0.79	3.63	3.90	36	18	46	36	18	46	1,647	1,647	179,523
150	C	B	B	1	112	113	0.01	0.75	0.75	3.44	3.69	39	17	44	39	17	44	1,492	1,492	167,104
160	C	B	B	1	113	114	0.01	0.71	0.71	3.26	3.49	42	17	41	42	17	41	1,257	1,257	142,041
170	C	B	B	1	112	113	0.01	0.66	0.66	3.10	3.31	45	16	39	45	16	39	937	937	104,944
180	C	B	B	0	111	111	0.00	0.62	0.62	2.94	3.14	48	15	37	48	15	37	69	0	7,659
190	C	B	B	0	108	108	0.00	0.57	0.57	2.80	2.98	50	15	35	50	15	35	14	0	1,512
200	C	B	B	0	105	105	0.00	0.53	0.53	2.66	2.82	53	14	33	53	14	33	16	0	1,680

10.0 REFERENCES

Bates, D.M. and Watts, D.G. 1998. Nonlinear regression analysis and its applications. John Wiley and sons, New York.

Huang, S. 1994. Ecologically based individual tree volume estimation for major Alberta tree species. Report #1. Alberta Environment Protection, Land and Forest Services, Forest Management Division.

SAS Institute Inc. 2004. SAS/STAT User's Guide, Version 9, Cary, NC: SAS Institute Inc.

APPENDICES

Appendix-1

ASRD Approval Letter of DMI's Monitoring and Growth and yield Program

May. 18. 2007 3:00PM No. 0498 P. 2

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WOODLANDS

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

Forestry Division
Forest Management Branch

7th Fl. 9920 – 108 Street
Edmonton, AB T5K 2M4

Phone: (780) 427 – 8474
Fax: (780) 427-0085

06298-10
06298-R01-01

May 8, 2007

Mr. Joerg Goetsch
Business Unit Leader, Forest Resource
Daishowa-Marubeni International ltd.
c/o Peace River Pulp Division
Postal Bag 6500 (Main Woodlands Office)
Peace River, AB T8S 1V5

Dear Mr. Goetsch:

RE: APPROVAL - GROWTH AND YIELD PLAN

The department has completed its review of the document entitled "2005 Monitoring and Growth & Yield Program (September 14th, 2006)" as submitted by Daishowa-Marubeni International Ltd (DMI). This is a re-submission, revised to address points of concern and discussion outlined in a review of an earlier version of the program. The documentation sufficiently addresses all previously outlined concerns, and therefore I am pleased to approve the plan/program.

The succession pathway strata outlined in this program are not directly compatible with the provincial base strata. DMI will need to address this incompatibility during the development of Alternative Regeneration Standards, as regeneration reporting and balancing will have to fit the provincial base strata.

Yours truly,

Robert Stokes, RPF
Senior Manager
Forest Planning Section

cc: Daryl Price, Senior Manager, Resource Analysis Section, FMB
Dave Morgan, Manager, Forest Biometrics Unit, FMB
Tom Archibald, Forestry Manager, Peace Area
Darren Aitkin, Growth and Yield Forester, FMB

Appendix-2

Tree Tally Audit Data

PLOT NUMBER	TREE NUMBER	SECTION		TREE SPECIES		BREAST HEIGHT (m)		DBH (cm)		CROWN CLASS		TREE HEIGHT (m)		HEIGHT TO CROWN		CC1		CC2		CC3	
		Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit
5182	2	1		Sw	Sw	1.3		11.9	11.9	I	I	11.4	10.8	7.5	7						
5182	12	1		Aw	Aw	1.3		13.3	13.1	C	C	15.2	14.8	10.3	10.5	11	11				
5182	22	2		Aw	Aw	1.3		14.5	14.6	C	C	16.2	16.6	11.8	11.5	11	11				
5182	32	3		Sw	Sw	1.3		11.4	11.4	I	I	11.3	12.8	3.6	3.5						
5182	43	4		Sw	Sw	1.3		13.4	13.4	I	I	12.7	14.1	4.9	9						
5182	52	4		Aw	Aw	1.3		19.8	19.9	C	C	16.7	17	12.5	13	11	11				
5182	62	6		Sw	Sw	1.3		9.1	9.1	I	I	11.5	11.7	8.7	7.6						
5182	72	7		Sw	Sw	1.3		10.9	10.8	I	I	13	13.7	7.1	6.5						
5182	82	8		Aw	Aw	1.3		18.8	18.9	C	C	16.2	16.8	12.2	12.6	11	11	25	25		
5182	85	7		Sw	Sw	1.3		9.2	9.2	I	I	11.1	11.2	6.3	6						
5189	3	2		Pb	Pb	1.3		10	9.9	I	I	8.5	8.7	3.7	4.1	11	11				
5189	4	6		Aw	Aw	1.3		21.2	21.1	I	I	16.7	17	8.1	8.5	11	11				
5189	12	7		Sb	Sb	1.3		9.5	9.6	I	I	9.4	1	2.8	2.5						
5189	14	8		Aw	Aw	1.3		12.3	12.1	S	S	12	12.6	8	8	11	11				
5194	1	1		Aw	Aw	1.3		11.2	11.2	X	X					4	4				
5194	11	1		Sw	Sw	1.3		19.5	19.3	I	I	17.3	17.1	6	5.5						
5194	21			Pb	Pb	1.3		11.6	11.4	S	S	12.8	13.3	7.7	7	11	11				
5194	31			Sb	Sw	1.3		12.1	12	S	S	12.2	13	4.6	4						
5194	41			Sb	Sb	1.3		10.3	10.1	S	S	10.2	10	4	3.7						
5194	53			Pb	Pb	1.3		29.9	29.9	C	C	20.5	21.2	13.7	14.5		19				
5194	61			Pb	Pb	1.3		30.3	30.3	I	I	19.2	20.1	13.8	14						
5194	68			Sb	Sb	1.3		10.5	10.5	S	S	11.9	11.4	5.1	4.5						
5204	4	1		Sw	Sw	1.3		10.5	10.6	S	S	10.8	10.3	3.3	3	18	18				
5204	14	2		Sw	Sw	1.3		18.2	18.2	C	C	21	20.3	8.2	8	10	10				
5204	24	4		Sw	Sw	1.3		22.2	22.2	C	C	21.4	20.8	12.6	13						
5204	34	6		Pb	Pb	1.3		12.7	12.7	I	I	15	15.3	10.8	11	11	11				
5204	44	7		Pb	Pb	1.3		14.2	14.3	I	I	17.1	17	9.4	9.9	11	11				
5204	53	3		Sw	Sw	1.3		13.2	13.2	S	S	11.3	10.7	5.5	6	11	11				
5204	54	6		Sw	Sw	1.3		15.7	15.8	S	S	12.4	12.1	3.5	3.5	11	11				
5215	2	1		Sb	Sb	1.3		9.1	9.1	S	S	8.6	8.2	1.7	1.8						
5215	12	3		Sb	Sb	1.3		12.7	12.8	I	I	11.3	11.4	1.9	1.5						
5215	22	3		Pl	Pl	1.3		10.8	10.8	I	I	12.6	12.2	7.7	8.2						
5215	32	4		Pl	Pl	1.3		14.3	14.3	C	C	15.3	15.8	10.9	11.2	10	10				
5215	42	5		Pl	Pl	1.3		17.3	17.4	C	C	17.5	17.1	11.9	10.7						
5215	52	6		Pl	Pl	1.3		19.7	19.8	C	C	17.9	18.4	10.7	11						
5215	62	6		Pl	Pl	1.3		20.7	20.6	C	C	17.2	17.5	11.4	11.3						
5215	72	7		Pl	Pl	1.3		10.4	10.5	S	S	7.3	6.7	5.7	5.2	9	8				
5215	73	7		Pl	Pl	1.3		15.6	15.5	C	C	14.8	14.8	10.7	9.8						
5220	1	1		Aw	Aw	1.3		22.9	22.9	C	C	22.2	22.7	11.7	12	11	11				
5220	11	2		Aw	Aw	1.3		13	12.9	I	I	16.6	17	9.3	10.5	11	11				
5220	21	3		Aw	Aw	1.3		23.3	23.3	C	C	22.6	22.9	12.6	11.9	11	11				
5220	33	6		Aw	Aw	1.3		18.4	18.3	C	C	21.6	22	11.8	11.5	11	11				
5220	42	8		Aw	Aw	1.3		14.8	14.7	S	S	17.7	18.1	11.1	12	12	12				
5229	4	1		Aw	Aw	1.3		17.9	17.9	I	I	16.9	17.1	10.2	11.3						
5229	14	3		Aw	Aw	1.3		16.1	16.2	I	I	15.1	16	11.1	11	11	11				
5229	24	4		Sb	Sb	1.3		9.5	9.6	S	S	7.7	8	1.6	1.5						
5229	33	6		Pl	Pl	1.3		24.6	25	C	C	20.2	19.9	12.3	11.5	11	11				
5229	43	8		Aw	Aw	1.3		14.7	14.8	I	I	14.6	15.4	10.1	10	11	11				
5229	45	8		Pl	Pl	1.3		22.5	22.7	C	C	20.8	20.6	10.1	10.5	18	18	11	11		
5233	2	2	2	Sw	Sw	1.3	1.18	29.9	29.8	C	C	19.6	19.5	11.9	7.3						
5233	6	3	3	Sw	Sw	1.3	1.2	18.2	18.2	C	C	16.9	17.2	4.1							
5233	11	4	4	Aw	Aw	1.3	1.3	16.7	17.2	C		17.2	17.5	10.6	11						
5233	16	4	4	Aw	Aw	1.3	1.3	9.1	8.7	S		8.4		6.5		11					
5233	21	5	5	Aw	Aw	1.3	1.3	17.8	17.4	C	C	16.2	15.7	13.1	13	11	11		12		
5233	26	5	6	Aw	Aw	1.3	1.3	14.3	14.1	C	C	17.1	16.7	11.6	11	11	12				
5233	31	6	6	Sw	Sw	1.3	1.3	13.1	13.2	S	I	12.6	13	1.9	1.5						
5233	36	8	7	Sw	Sw	1.3	1.3	18.7	18.6	C	C	18.3	19.5	10.3	7						
5238	1	1	1	Sb	Sb	1.3	1.3	9.9	9.8	C	C	9.5	9.7	4.5	4.9						
5238	5	2	1	Lt	Lt	1.3	1.3	9.3	9.3	C	C	11.8	11.9	6.6	7						
5238	10	3	3	Sb	Sb	1.3	1.2	10	10.1	C	C	10.2	10.7	6.4	6.4						
5238	15	4	3	Sb	Sb	1.3	1.25	10	10	C	C	10.1	10.3	6.2	7.3	18	18				
5238	20	6	6	Sb	Sb	1.3	1.3	10.8	10.8	C	C	12	11.8	5.3	5.9						
5238	25	8	8	Sb	Sb	1.3	1.35	11.4	11.3	C	C	9.5	9.5	6.4	6.4						
5243	3	1	1	Pb	Pb	1.3	1.3	21.1	21.2	C	C	17.8	17.8	13.9	12.1	11					
5243	8	3	2	Pb	Pb	1.3	1.3	21.2	21.4	I		16.5	15.8	12.7	8.2	11	11	22	22		
5243	13	4	4	Pb	Pb	1.3	1.3	17	17.2	I	I	14.5	14.4	12.2	12.2	18	18				
5243	18	5	5	Aw		1.3	1.3	10.4	10.3	X						4	4	18			
5243	23	6	6	Aw	Aw	1.3	1.3	13.5	13.6	I	I	16	15.8	10.6	9.4	11	11				
5243	28	8	8	Sw	Sw	1.3	1.3	17.7	17.9	I	I	14.1	14.2	2.1	2						
5243	33	8	8	Sw	Sw	1.3	1.3	22.7	22.8	C	C	17.4	17.6	3.4	2.9						
5244	1	1	8	Aw	Aw	1.3	1.3	12	12.1	C	C	7.3	7.3	3.9	3.5	11		10	10		
5244	2	2	2	Aw	Aw	1.3	1.3	11.1	11	C	C	8.8	9.1	5.1	5	11					
5244	3	3	2	Aw	Aw	1.3	1.3	12.6	12.6	C	C	9.5	9.9	6.1	5	11	11				
5244	5	6	6	Pl	Pl	1.3	1.3	15	15.1	C	O	7.7	8.1	0.4	1.6	11	11				
5244	6	7	6	Pl	Pl	1.3	1.34	9.4	9.3	C	O	7.1	7.3	0.25	1.5						
5254	1	1	1	Sw	Sw	1.3	1.2	36.9	37.3	C	C	20.6	21.7	3.6	3.6						
5254	5	2	1	Aw	Aw	1.3	1.3	26.8	26.8	C	C	20.9	21.3	13.4	14	11	11				

PLOT NUMBER	TREE NUMBER	SECTION		TREE SPECIES		BREAST HEIGHT (m)		DBH (cm)		CROWN CLASS		TREE HEIGHT (m)		HEIGHT TO CROWN		CC1		CC2		CC3	
		Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit
5254	10	4	3	Sw	Sw	1.3	1.2	9.3	9.4	S	I	8.8	8.7	2.6	4.1	10	10				
5254	15	5	5	Sw	Sw	1.3	1.3	11.7	11.9	S	I	11.1	11.6	1.8	4.2	11	11				
5254	20	6	6	Sw	Sw	1.3	1.3	9.4	9.4	S	I	10.1	10	2.4	3.1						
5254	25	8	7	Sw	Sw	1.3	1.3	32.7	32.8	C	D	23.2	23.5	7.2	5						
5255	2	1	1	Aw	Aw	1.3	1.3	32.3	32.5	C		25.3	24.8	12	14.8	12	12				
5255	6	3	2	Aw	Aw	1.3	1.2	11.1	11	S	I	12.6	12.2	5.9	8.7	11					
5255	11	4	4	Aw	Aw	1.3	1.3	34.6	34.6	C	C	21.5	22.4	15	14.4	11	19	15	15	12	16
5255	21	5	5	Aw	Aw	1.3	1.2	9.7	9.9	S	I	13.1	13.7	4.8	4.9						
5255	26	6	6	Aw	Aw	1.3	1.3	36.1	36.1	C	C	21.4	20.7	14	13.5	19	19	12	12	11	
5255	31	8	8	Aw	Aw	1.3	1.3	35.7	35.7	C	C	24.6	24.9	14.7	15						
5268	3	2	1	Aw	Aw	1.3	1.2	30.9	29.9	C	C	21.1	21.5	14.5	14.5	15		11			
5268	8	4	3	Sw	Sw	1.3	1.1	14.8	14.7	S	I	13.8	14.2	4.1	4.5						
5268	13	4	5	Sw	Sw	1.3	1.2	34.5	34.7	C	D	22.7	22.1	14	4.5		19				
5268	18	5	6	Sw	Sw	1.3	1.2	9.3	9.3	S	I	9.5	9.8	2	2						
5273	4	2	1	Pb	Pb	1.3	1.2	25.4	24.7	C	C	22.1	22.4	11.8	11.6						
5273	5	3	2	Pb	Pb	1.3	1.3	14.2	14.2	I	I	18.1	18.2	6.8	6.6						
5273	9	4	4	Aw	Aw	1.3	1.2	29.7	29.3	C	C	27.4	24.4	16.9	16.5		15				
5273	13	5	5	Aw	Sw	1.3	1.2	29.9	34.7	C	D	24.6	22.1	18.9	4.5	15	19				
5273	18	6	6	aw	Sw	1.3	1.2	28.2	9.3	C	I	30.4	9.8	23.3	2		11				
5282	1	1	1	Sw	Sw	1.3	1.3	45.6	45.7	C	C	31	29	10.9	8.9						
5282	11	3	3	Aw	Aw	1.3	1.3	40.3	40.3	C	C	25.9	25.9	21.4	21	10	10	11			
5282	21	5	5	Sw	Sw	1.3	1.3	18.1	18.1	I	I	16.5	16.2	3.5	3.5						
5282	22	6	6	Aw	Aw	1.3	1.3	45	45.1	C	C	29.6	30.2	19.7	20	11		15	15		
5282	23	6	6	Sw	Sw	1.3	1.3	57.2	57.1	C	C	28.2	27.7	2.4	2.4						
5282	31	8	8	Sw	Sw	1.3	1.3	10.1	10.1	S	S	11.3	11.1	2.1	2.1						
5283	12	7	7	Sw	Sw	1.3	1.3	69.3	69.3	D	D	34.7	32	2	2	13					
5283	14	7	7	Aw	Aw	1.3	1.3	28.3	28.3	C	C	24.7	24.2	17.7	17.5	11					
5283	15	8	8	Aw	Aw	1.3	1.3	42.9	42.8	C	D	32.9	32.1	22.6	23	11					
5283	16	8	9	Aw	Aw	1.3	1.3	31.2	31.3	I	C	23.1	23	17.8	17.8	11					
5284	4	2		Sw	Sw	1.3	1.3	63.8	64	C	C	32	31.9	3.2	2.9						
5284	13	6		Pb	Pb	1.3	1.3	30.8	31.1	I	I	21.8	22.9	13		9	9				
5284	14	7		Sw	Sw	1.3	1.3	72.1	71.9	D	D	39.8	40.4	4.1	4.1						
5284	15	7		Sw	Sw	1.3	1.3	11.6	11.7	S	S	9.4	9.7	2.7	3.1						
5284	16	8		Sw	Sw	1.3	1.3	86.2	85.7	C	C	35.5	36.1	4.4	4						
5290	4	1		Sw	Sw	1.3	1.3	10.1	10.1	S	S	6	6.1	2.7	2.4	8	18	11			
5290	14	2		Sw	Sw	1.3	1.3	15.9	16	I	I	11.7	13.6	1.8	2.3						
5290	24	3		Sw	Sb	1.3	1.3	18.4	18.5	I	I	14.9	15.7	7.3	6						
5290	34	5		Sb	Sb	1.3	1.3	9.7	9.8	I	I	9.9	10.3	5.6	5						
5290	44	6		Sb	Sb	1.3	1.3	15.2	15.3	I	I	11.5	12	3	3.2	12					
5290	54	6		Sw	Sb	1.3	1.3	11.2	11.3	I	I	11.3	12	5	4.5						
5290	64	7		Sw	Sb	1.3	1.3	17.1	16.7	I	I	13.2	13.7	6.7	6.1						
5290	74	8		Sb	Sb	1.3	1.3	10.6	10.8	I	I	11.1	11.4	1.3	1.5						
5290	81	8		Sb	Sb	1.3	1.3	15.2	15.4	I	I	13.4	13.7	3.2	2.9						
5291	2	1	1	Sw	Sb	1.3	1.3	10.2	10.4	I	I	7.9	7.7	0.8	0.8						
5291	12	4	4	Sw	Sb	1.3	1.3	10.2	10.2	I	I	7	6.9	2.9	2.8						
5291	22	4	4	Pl	Pl	1.3	1.3	20	20.1	C	C	16	16.2	5.2	5.2	11					
5291	31	8		Sw	Sb	1.3	1.3	10.8	10.9	I	I	9.5	9.7	2.3	2.3						
5291	32	8		Sw	Sb	1.3	1.3	10.3	10.4	I	I	8	8.2	2	2						
5292	3	1	1	Pl	Pl	1.3	1.3	9.8	9.8	C	C	10	10.1	5.2	5.2						
5292	13	3	3	Sw	Sb	1.3	1.3	13.5	13.6	C	C	10.9	11	4.8	4.8						
5292	23	5	5	Pl	Pl	1.3	1.3	9.9	9.9	I	I	9.9	10.2	6.6	6.6						
5292	33	6	6	Sw	Sb	1.3	1.3	10.2	10.3	I	I	9.5	9.5	5	5						
5292	43	8	8	Aw	Aw	1.3	1.3	9.1	9.2	I	I	7.5	7.5	6	6	11					
5703				No trees																	
5712	2	2	2	SB	SB	1.3	1.3	14.3	14.5	I	I	13.4	12.8	6.3	5.8	12	12				
5712	12	5	5	SB	SB	1.3	1.3	12.8	12.9	S	S	10.4	10.2	3	2.4	19	19	12	12		
5712	22	4	4	SB	SB	1.3	1.3	14.8	14.9	I	I	13.2	13	8.6	6	12	12				
5712	32	5	5	SB	SB	1.3	1.3	18.5	18.7	C	C	16.4	15.9	8.8	8.2						
5712	33	5	5	LT	LT	1.3	1.3	32.7	33	D	D	19.6	19.3	9.3	11.1						
5712	35	5	5	SB	SB	1.3	1.3	20.2	20.3	C	C	16.4	16.5	8.7	7.5	12	12				
5712	42	5	5	SB	SB	1.3	1.3	13	12.9	S	S	9.4	10.1	6.3	4.1						
5712	52	6	6	SB	SB	1.3	1.3	15.4	15.5	S	S	11.3	11.1	5.3	5.8	12					
5712	53	6	6	LT	LT	1.3	1.3	27	26.9	C	C	17.5	17.8	8.2	8.3						
5712	62	7	7	SB	SB	1.3	1.3	13	13	S	S	9.5	9.7	1.3	1.3	09	09				
5712	72	7	7	SB	SB	1.3	1.3	10	9.5	S	S	9.1	9.8	5.3	4.5	09	09				
5712	73	8	8	SB	SB	1.3	1.3	17.1	17.3							05	05				
5713				No trees																	
5714	1	1	1	PB	PB	1.3	1.3	30.4	30.5	C	C	21.7	23.3	12.8	13.8						
5714	2	1	1	PB	PB	1.3	1.3	29.8	30	C	C	22.4	23.1	8.8	10.9						
5714	11	6	6	PB	PB	1.3	1.3	22.6	22.7	C	C	20.2	21.6	14.5	12.6	22	22				
5714	18	8	8	PB	PB	1.3	1.3	24.5	24.9	C	C	22.8	22.5	13.4	12.9						
5714	19	8	8	PB	PB	1.3	1.3	27.6	27.6	C	C	22.4	22.3	15.6	12.9						
5715	3	1	1	AW	AW	1.3	1.3	26.2	26.3	C	C	24.5	25.3	18	19	11	11				
5715	12	3	3	PB	PB	1.3	1.3	16.5	16.6	I	I	16.3	16.3	11.6	11.8	19	19				
5715	20	5	5	PB	PB	1.3	1.2	32.6	32.5	C	C	21.3	21.6	15.6	14.1						
5715	22	5	5	PB	PB	1.3	1.3	20.2	20.9	I	I	17.9	19.1	10.4	10.1		18				
5715	30	8	8	AW	AW	1.3	1.2	36	35.8	D	D	25.3	26	15.2	13.8						

PLOT NUMBER	TREE NUMBER	SECTION		TREE SPECIES		BREAST HEIGHT (m)		DBH (cm)		CROWN CLASS		TREE HEIGHT (m)		HEIGHT TO CROWN		CC1		CC2		CC3	
		Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit
5715	31	8	8	AW	AW	1.3	1.2	34.2	34	D	D	26.5	26.8	16.6	16.3						
5715	32	8	8	AW	AW	1.3	1.2	16.6	16.1	S	S	15.5	15.9	11.4	11.5	17	15				
5715	33	8	8	PB	PB	1.3	1.3	21.9	22	I	I	19.9	20.7	16	15.8	20					
5716	1	1	1	PB	PB	1.3	1.2	21.4	21.4	I	I	16.9	17.3	9.3	9.8						
5716	11	5	5	PB	PB	1.3	1.3	12.4	12.5	I	I	15.2	15.4	10.8	9.9	19	19				
5716	14	6	6	AW	AW	1.3	1.2	30.4	30.5	C	C	23.5	24	11.9	11.8						
5716	15	6	6	AW	AW	1.3	1.3	27.9	27.9	C	C	22.9	23.2	11.2	10.9						
5716	21	7	7	AW	AW	1.3	1.2	41.3	41	C	C	21.3	21.5	12.6	12.5	19	19	10	10	17	15
5716	26	8	8	PB	PB	1.3	1.2	21.1	21.1	C	C	21.3	21.7	9.8	11	19	19				
5716	27	8	8	PB	PB	1.3	1.3	12.9	13	S	S	14.3	14.8	7.4	7.4	22	22	18	18		10
5719	15	4	4	SW	SW	1.3	1.2	34.7	34.6	D	D	26.3	24.5	15.5	9.1						
5719	25	5	5	SW	SW	1.3	1.3	20.4	20.4	I	C	18	17.5	5.6	6.3						
5719	36	8	8	FB	FB	1.3	1.3	12.9	13	I	C	15.6	15.4	9.5	9.2	09	09				
5719	40	8	8	SW	SW	1.3	1.2	16.7	16.8	I	C	17.2	16.2	8	7.4		18				
5719	998	6	6	SW	SW	1.3	1.2	31	31.2	C	C	21	19.9	10.7	7.6						
5719	999	1	1	SW	SW	1.3	1.3	34	34.5	D	D	24.3	23.4	11.1	11.1						
5724	6	1	1	SW	SW	1.3	1.3	10.9	10.9	S	I	14.5	13.9	9.9	9.4						
5724	16	2	2	FB	FB	1.3	1.3	13.5	13.3	S		10.5		6.7		09	05				
5724	26	3	3	SW	SW	1.3	1.3	13.8	13.7	S	S	13.7	13.2	6.1	6.8						
5724	33	4	4	SW	SW	1.3	1.3	28.8	28.7	C	C	22.6	21.8	12.4	11						
5724	46	5	5	AW	AW	1.3	1.3	19.9	19.9	C	C	20.7	21.4	10.7	12						
5724	56	7	7	SW	SW	1.3	1.3	13.2	13.2	S	S	11.6	11.7	8.4	7.3						
5724	66	7	7	SW	SW	1.3	1.3	12.8	12.9	S	S	13.9	13.9	8.6	8.8						
5724	71	7	7	SW	SW	1.3	1.3	25.1	25.2	C	C	21.2	20.7	12.7	10.4						
5724	79	8	8	AW	AW	1.3	1.3	27.4	27.4	C	C	22.9	23	15.8	10.1		10				
5724	86	8	8	AW	AW	1.3	1.3	17.1	17	I	I	19.4	19	12.5	11.9						
5724	96	8	8	AW	AW	1.3	1.3	21.3	21.3	C	C	20.2	19.6	15.5	15						
5724	103	6	6	SW	SW	1.3	1.3	14.3	14	S	S	13.3	13.4	8.1	8.2		19				
5725	1	1	1	SW	SW	1.3	1.3	10.9	10.9	S	I	11.9	12	5.4	5.2						
5725	2	1	2	SW	SB	1.3	1.2	25.8	25.8	I	I	18.1	17.4	6.5	5.8		11		18		
5725	7	2	2	SW	SB	1.3	1.2	15.9	15.9	S	I	15.6	15	8.4	5.7						
5725	17	3	3	SW	SW	1.3	1.3	24.3	24.3	C	C	19.3	18.7	7	6						
5725	27	3	3	SW	SB	1.3	1.3	10	10	S	I	11.7	12.1	6.8	6						
5725	38	4	4	SW	SB	1.3	1.2	10.4	10.4	S	S	12.4	12.5	8.1	8						
5725	47	5	5	SW	SB	1.3	1.3	14.5	14.5	S	I	13	13	5.5	5.5		10				
5725	57	6	6	SW	SB	1.3	1.3	16.9	16.7	S	I	13.5	13.1	6.8	6.3						
5725	67	7	7	SW	SB	1.3	1.3	27.9	27.6	I	C	16.4	15.7	9.5	7.5	09	10				
5725	68	7	7	SW	SW	1.3	1.3	40.4	40.5	D	D	22.7	22.2	8	6.5	20					
5725	77	8	8	SW	SW	1.3	1.3	19.1	18.8	I	I	16.1	15.7	8.4	5.9	11	11	22	22		
5725	78	8	8	SW	SW	1.3	1.3	25.7	25.7	I	I	17.5	16.9	9.5	9.5	20					
5733	4	1	1	Sw	Pl	1.3	1.2	9.6	22	S	C	7.1	15.3	0.9	5						
5733	5	1	1	Pl	Sw	1.3	1.2	19.7	9.6	C		14.4	7.3	7.5	1.9	9					
5733	9	2	2	Pl	Pl	1.3	1.2	17	22.8	C		12.7	14.8	7.9	5.3	9		12		18	
5733	19	8	8	Sw	Pl	1.3	1.1	11.4	9.5	I	I	7.8	8.2	1.5	2.4						
5733	22	8	8	Pl	Pl	1.3	1.2	25.8	24.7	C	C	15.4	16.9	7	6.9	18					
5733	29	8	8	Pl	Sw	1.3	1.2	27	10	C	I	15.7	10.5	4.9	1.9	10					
5734	4	1	1	Pl	Pl	1.3	1.3	23.4	23.3	C	C	22.8	21.7	16.9	17.1						
5734	7	1	1	Pl	Pl	1.3	1.2	16.7	16.7	I		18.6	17.9	14.5	12.9	11					
5734	8	1	1	Pl	Pl	1.3	1.2	28.7	28.6	C	C	23.6	22.7	17.8	16.9						
5734	17	2	2	Pl	Pl	1.3	1.2	19.2	19	C	C	20.5	20.4	16.2	15.6	17		19	19		
5734	27	3	3	Fb	Fb	1.3	1.2	15	15	I	I	14.9	14.7	3.1	3	11	11	12			
5734	38	5	5	Pl	Pl	1.3	1.1	18.6	18.5	C	C	20.8	20.2	16.4	15	11	11	12	12	18	18
5734	46	5	5	Fb	Fb	1.3	1.2	23.2	23.1	C	C	20.3	20.1	7.1	7.5						
5734	57	6	6	Pl	Pl	1.3	1.2	14.3	14.4	C	C	21.9	21.8	19	19	11	11				
5734	68	8	8	Pl	Pl	1.3	1.2	22	21.9	C	C	23.9	22.9	19.1	18.8						
5734	73	8	8	Pl	Pl	1.3	1.2	19	19	C	C	21	20.3	15	14.8	18		19	19		
5740	2	2	2	Sw	Sw	1.3	1.3	10.5	10.6	S	S	7.8	7.8	2.6	2.6						
5740	3	3	3	Aw	Aw	1.3	1.2	35.4	35.3	C	C	21.3	21.3	11.9	11.5						
5740	4	3	3	Aw	Aw	1.3	1.3	32	31.8	C	C	21.2	21.8	11	10.6	11					
5740	9	5	5	Aw	Aw	1.3	1.3	37.2	37.3	C	C	21.2	21.5	12	12	11		18	18		
5740	12	6	6	Aw	Aw	1.3	1.3	35.8	35.6	C	C	24.4	23.7	14.2	12.9	11	11	10			
5743	3	1	1	Sb	Sb	1.3	1.3	12.2	12.2	C	C	11.1	10.8	6.1	6						
5743	13	1	1	Sb	Sb	1.3	1.3	10.7	10.5	C		10.4	7.2	7.6	12	17	17				
5743	23	1	1	Sb	Sb	1.3	1.3	9.8	9.9	C	C	10.3	10.1	6	5.7		11				
5743	33	2	2	Sb	Sb	1.3	1.3	15	15.1	D	D	13.7	13.4	5.7	6	10	10				
5743	34	2	2	Sb	Sb	1.3	1.3	10.2	10.1	C	C	12.7	12.1	6.1	6.3						
5743	43	3	3	Sb	Sb	1.3	1.3	10.9	11	I	I	9.6	9.3	7.1	6.5						
5743	53	4	4	Sb	Sb	1.3	1.3	9.2	9.3	I	I	9.2	8.6	6.4	6	9	9				
5743	56	4	4	Sb	Sb	1.3	1.3	13.8	13.9	C	C	14.2	14	5.9	6.7						
5743	63	5	5	Sb	Sb	1.3	1.3	12.5	12.3	C	C	13.1	12.4	7	6						
5743	71	5	5	Sb	Sb	1.3	1.3	15.5	15.5	D	D	13.5	13.1	5.3	5.5						
5743	76	6	6	Sb	Sb	1.3	1.3	12.6	12.7	C		10.3	10.1	5.7	5.5		19				
5743	83	7	7	Sb	Sb	1.3	1.3	11.9	11.9	C	C	11.7	11.3	3.6	4.1						
5743	93	7	7	Sb	Sb	1.3	1.3	9.4	9.5	C	C	8.7	8.6	3.8	3.9	10	10				
5743	103	8	8	Sb	Sb	1.3	1.3	10.4	10.3	C	C	10.6	11.7	7.9	7.5	11	11				
5743	113	8	8	Sb	Sb	1.3	1.3	9.9	10	C	C	9.9	9.5	6	4.2						
5745	1	1	1	Aw	Aw	1.3	1.3	27.7	27.8	C	C	24.6	23.1	15.9	13	10		19			

PLOT NUMBER	TREE NUMBER	SECTION		TREE SPECIES		BREAST HEIGHT (m)		DBH (cm)		CROWN CLASS		TREE HEIGHT (m)		HEIGHT TO CROWN		CC1		CC2		CC3	
		Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit
5745	1	1	1	Aw	Aw	1.3	1.3	27.7	27.8	C	C	24.6	23.1	15.9	13	10		19			
5745	11	1	1	Aw	Aw	1.3	1.3	24.4	24.6	C	C	23.1	24	17.4	17.1						
5745	11	1	1	Aw	Aw	1.3	1.3	24.4	24.6	C	C	23.1	24	17.4	17.1						
5745	16	2	2	Aw	Aw	1.3	1.2	26.5	26.7	C	C	24.6	23.9	17	16.2	18	18				
5745	16	2	2	Aw	Aw	1.3	1.2	26.5	26.7	C	C	24.6	23.9	17	16.2	18	18				
5745	22	3	3	Aw	Aw	1.3	1.3	25.8	35.8	C	C	22.6	22	13	13.8	13	13	18	18	19	19
5745	22	3	3	Aw	Aw	1.3	1.3	25.8	35.8	C	C	22.6	22	13	13.8	13	13	18	18	19	19
5745	31	6	6	Aw	Aw	1.3	1.3	18.7	18.7	C	C	22.9	23.6	15.2	15		11				
5745	31	6	6	Aw	Aw	1.3	1.3	18.7	18.7	C	C	22.9	23.6	15.2	15		11				
5745	34	6	6	Sw	Sw	1.3	1.2	28.7	28.7	C	C	17.3	17.2	1.5	1.5						
5745	34	6	6	Sw	Sw	1.3	1.2	28.7	28.7	C	C	17.3	17.2	1.5	1.5						
5745	40	8	8	Aw	Aw	1.3	1.3	25.5	25.7	C	C	24.4	25	14.1	17.1						
5745	40	8	8	Aw	Aw	1.3	1.3	25.5	25.7	C	C	24.4	25	14.1	17.1						
5745	41	8	8	Aw	Aw	1.3	1.3	26.4	26.4	C	C	22.2	23.3	14.5	15.2						
5745	41	8	8	Aw	Aw	1.3	1.3	26.4	26.4	C	C	22.2	23.3	14.5	15.2						
5745	44	5	5	Aw	Aw	1.3	1.3	10.7	10.9	x	S	n/a	12.5	n/a	7.8		18		9		
5745	44	5	5	Aw	Aw	1.3	1.3	10.7	10.9	x	S	n/a	12.5	n/a	7.8		18		9		
5748	15	3	3	Fb	Sw	1.3	1.3	10.3	10.4	S	S	9.3	9.4	2.8	1.8						
5748	15	3		Fb	Sw	1.3	1.3	10.3	10.4	S	S	9.3	9.4	2.8	1.8						
5748	18	4	4	Sw	Sb	1.3	1.3	18.5	18.7	C	I	14.4	14.3	1.6	2.3						
5748	18	4		Sw	Sb	1.3	1.3	18.5	18.7	C	I	14.4	14.3	1.6	2.3						
5748	21	7		Fb	Fb	1.3	1.3	17.3	17.4	C	I	18.4	18	3.8	9.3						
5748	21	7		Fb	Fb	1.3	1.3	17.3	17.4	C	I	18.4	18	3.8	9.3						
5748	24	6		Fb	Fb	1.3	1.3	9.3	9.4	x		n/a		n/a		4	4				
5748	24	6		Fb	Fb	1.3	1.3	9.3	9.4	x		n/a		n/a		4	4				
5748	27	7		Fb	Fb	1.3	1.3	14.7	14.8	C	I	17.1	15.9	7	8.4	12		18	18		
5748	27	7		Fb	Fb	1.3	1.3	14.7	14.8	C	I	17.1	15.9	7	8.4	12		18	18		
5748	33	7		Fb	Fb	1.3	1.3	22.5	22.8	C	I	17.1	17.2	4.9	4.8	16	16	17	10		
5748	33	7		Fb	Fb	1.3	1.3	22.5	22.8	C	I	17.1	17.2	4.9	4.8	16	16	17	10		
5748	34	8		Bw	Fb	1.3		16.4		I		14.3		3.1							
5748	34	8		Bw	Fb	1.3		16.4		I		14.3		3.1							
5748	38	8	8	Fb	Fb	1.3	1.3	22.6	22.9	C	I	15.8	15.7	5.2	5.6						
5748	38	8		Fb	Fb	1.3	1.3	22.6	22.9	C	I	15.8	15.7	5.2	5.6						
5749	4	1	1	Sw	Sw	1.3	1.3	12.9	13	I	I	18.3	18.3	9.6	10.1	12	12				
5749	14	4	4	Sw	Sw	1.3	1.3	32.7	32.8	C	C	26.3	24.2	10.3	10						
5749	26	6	6	Sw	Sw	1.3	1.2	21.8	21.4	C	C	21.9	22.2	13.1	10.3						
5749	34	7	7	Sw	Sw	1.3	1.3	24.3	24.5	C	C	23.8	24.5	14.7	14	12	12				
5749	44	8	8	Sw	Sw	1.3	1.2	24.5	24.7	C	C	22.1	24.7	13.8	12.2						
5749	47	8	8	Sw	Sw	1.3	1.2	15.3	15.4	I	I	20.8	20.2	11.4	10.1	12	18				
5749	9997	6	6	Sw	Sw	1.3	1.3	26.8	26.8	D	D	23.9	24	15.3	15						
5749	9998	6	6	Sw	Sw	1.3	1.3	22.3	22.3	C	C	22.2	22.5	12.7	12.5						
5749	9999	7	7	Sw	Sw	1.3	1.3	27.5	27.6	D	D	24.6	24	14.3	14						
5753	2	1	1	Pb	Pb	1.3	1.3	19.1	19.5	I	I	18	18.3	10.9	10.1						
5753	12	3	3	Pb	Pb	1.3	1.3	23.3	23.4	C	C	19.8	19.9	9.1	9.2	11					
5753	22	3	3	Pb	Pb	1.3	1.3	19.4	19.4	C	C	17.4	17.6	10	9.2						
5753	32	5	5	Pb	Pb	1.3	1.3	16.9	17	I	I	17.2	17.4	9.9	8.4						
5753	42	7	7	Pb	Pb	1.3	1.3	33.7	33.8	C	C	20.9	21.4	8.8	8	13	10	18		17	
5753	52	8	8	Pb	Pb	1.3	1.3	17.3	17	I	I	16.1	16.7	9	8.8	18	18				
5753	9997	5	5	Pb	Pb	1.3	1.3	31.8	31.8	D	D	24.6	24.1	11.7	12.4	19	19				
5753	9998	5	5	Pb	Pb	1.3	1.3	25.3	25.5	C	C	20.5	21.1	11.1	10.8						
5753	9999	1	1	Aw	Aw	1.3	1.3	20.1	20.2	C	C	20.5	20.4	9.8	9.5						
5754	3	1	1	Aw	Aw	1.3	1.3	31.4	30.3	C	C	27.8	27.5	16.2	16.8	11	18		19		12
5754	13	3		Aw	Aw	1.3	1.3	16.1	16.1	S	S	14.5		11.9		12	5	11			
5754	23	5	5	Aw	Aw	1.3	1.15	29.8	28.9	C	C	25.4	25.3	13.8	15	10					
5754	34	7	7	Sw	Sw	1.3	1.3	21.3	21.2	C	C	21.4	20.6	12.9	13.1						
5754	44	8	8	Pl	Pl	1.3	1.3	33.2	32.9	C	C	28.5	27.8	19.2	18.1	10					
5754	51	8	8	Aw	Aw	1.3	1.3	27.7	27.5	C	C	27	26.2	18.5	17.4	11	18	12			
5754	9997	2	2	Aw	Aw	1.3	1.3	39.2	38.9	D	D	27.8	26.4	15.2	13.5	11					
5754	9998	7	7	Pl	Pl	1.3	1.3	32.6	32.7	D	D	28.2	28.5	17.7	16.5						
5754	9999	7		Pl	Pl	1.3	1.3	31	30.9	D	D	28.8	27.7	18	17.2						
5755	4	2	2	Sw	Sw	1.3	1.3	39.9	39.8	C	C	25.2	26	5.4	5.5						
5755	8	1	1	Aw	Aw	1.3	1.3	22.3	22.3	C	C	19.5	20.3	13.5	12.8	18	18				
5755	14	4	4	Sw	Sw	1.3	1.3	15	15.2	I	I	13.3	13	1.4	1.5	11	22	19			
5755	24	7	7	Sw	Sw	1.3	1.3	34.2	34.2	C	C	24.5	24.4	2.5	2.7						
5755	27	7	7	Sw	Sw	1.3	1.3	11	11	S	S	10.7	10.8	2.5	2.5						
5756	3	1	1	Sw	Sw	1.3	1.3	36.8	36.9	C	C	19.9	19.2	1.4	1.4	11	11				
5756	13	5	5	Sw	Sw	1.3	1.3	41.9	42	C	C	25.8	25.4	5.7	5.5	11	11				
5756	23	5	5	Aw	Aw	1.3	1.3	17.1	17.1	I	I	19.6	18.3	12.9	11	18	18	19	19		
5756	33	6	6	Aw	Aw	1.3	1.3	46.1	46.3	C	C	24.5	23.9	16	18.7	11		19	19		
5756	42	8	8	Pb	Pb	1.3	1.3	14.8	15	I	I	16.9	16.7	9	9.2	11	11				
5756	9997	2	2	Pb	Pb	1.3	1.3	27.7	28	C	C	25.1	23.9	1.5	13.6		18				
5756	9998	3	3	Aw	Aw	1.3	1.3	37.9	38.1	C	C	28.4	27.1	20.9	20.1	11	11	10	10		
5756	9999	3	3	Sw	Sw	1.3	1.3	44.7	45	C	C	27.9	27	3.1	4	11	11				
5758	1	1	1	Pb	Pb	1.3	1.3	21.2	21.1	I	I	18	17.6	12.8	12.6	11	19	17	11		
5758	11	1	1	Sb	Sb	1.3	1.3	9.9	10.1	S	S	12.6	12.3	5.2	5.9		12				
5758	21	3	3	Sw	Sw	1.3	1.3	21	21.1	D	C	19.8	19.3	12.1	13						
5758	31	3	3	Sw	Sw	1.3	1.3	19.3	19.3	C	C	18.6	18.2	10.2	11						

PLOT NUMBER	TREE NUMBER	SECTION		TREE SPECIES		BREAST HEIGHT (m)		DBH (cm)		CROWN CLASS		TREE HEIGHT (m)		HEIGHT TO CROWN		CC1		CC2		CC3	
		Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit
5758	41	4	4	Sb	Sb	1.3	1.3	15.9	16.1	C	C	17.9	17.5	8.3	8						
5758	51	4	4	Sw	Sw	1.3	1.3	10.1	10.1	I	I	12.2	12.1	6.7	7						
5758	62	5	5	Sw	Sw	1.3	1.3	13.7	13.8	I	I	15.9	16.7	10.5	10						
5758	71	6	6	Aw	Aw	1.3	1.3	42.7	42.6	D	D	23.1	22.6	11.4	11.3	13	20	11	19		
5758	81	7	7	Sb	Sb	1.3	1.3	18	18.1	C	C	16.9	16.2	10.3	11	11					
5758	91	7	7	Sb	Sb	1.3	1.2	17.8	17.9	C	C	17.6	17.6	12.7	12	18	19				
5758	102	8	8	Sw	Sw	1.3	1.3	20.3	20.1	D	D	19.4	19.2	10.3	10.2						
5758	105	3	3	Sw	Sw	1.3	1.3	16	16.1	C	C	18.9	18.6	13.3	13						
5758	9997	3	3	Sw	Sw	1.3	1.3	23.2	23.2	D	D	22.5	21.8	13.8	13						
5758	9998	2	2	Sw	Sw	1.3	1.3	21.3	21.2	D	D	20.1	19.8	9.7	10						
5758	9999	1		Sw	Sw	1.3	1.3	24.5	24.5	D	D	22.6	21.9	12.8	13						
5765	1	1	2	Sw	Sw	1.3	1.3	14.4	14.5	C	C	8.7	8.5	2	2						
5765	2	1	1	Sw	Sw	1.29	1.3	11.4	11.2	C	C	7.1	7.3	1.1	1						
5765	9997	1	5	Sw	Sw	1.3	1.3	12	12	C	C	8.5	8.3	0.7	1						
5765	9998	1	1	Sw	Sw	1.3	1.3	18.6	18.6	C	C	10.8	10.7	1.9	2						
5765	9999	1	1	Sw	Sw	1.3	1.3	11.1	11.2	C	C	7.4	7.7	1.7	1.5						
5766	18	2	2	Aw	Aw	1.3	1.3	14.6	14.5	C	C	18.1	17.9	14.4	14.1	18	18		19		
5766	28	3	3	Sw	Sw	1.3	1.3	15.3	15.3	I	I	14.6	14.6	3.8	4						
5766	37	3	3	Sw	Sw	1.3	1.3	18	18	I	I	15.9	15.7	8.7	8.1						
5766	48	4	4	Aw	Aw	1.3	1.3	12.2	12.2	I	I	15.2	14.6	11.1	10.7	15	11		15		
5766	58	5	5	Sw	Sw	1.3	1.3	14.1	14.1	C	C	17.2	16.6	6	5.2						
5766	69	5	5	Sw	Sw	1.3	1.3	21.6	21.6	C	C	18.8	18.1	2.6	3						
5766	79	7	7	Aw	Aw	1.3	1.3	10	24.5	X			19.7		12.8	4	18		19		
5766	89	8	8	Aw	Aw	1.3	1.3	15.6	15.4	C	C	18.9	19.5	14.1	13.7	11	11		19		
5766	91	8	8	Sw	Sw	1.3	1.3	9.7	9.8	I	I	13.9	13.6	3	2.7						
5767	5	1	1	Sw	Sw	1.3	1.3	20.4	20.3	C	C	19.1	18.6	10.3	7.2						
5767	15	2	2	Sw	Sw	1.3	1.3	15.8	15.8	I		15.4	15.3	9.2	9						
5767	25	3	3	Sw	Sw	1.3	1.3	11.7	11.8	I		15.2	14.6	10.5	10	19	19				
5767	35	3	3	Aw	Aw	1.3	1.25	18.9	19.3	C	C	19.6	18.8	13.2	14	11	11				
5767	39	3	3	Sw	Sw	1.3	1.3	29.5	29.6	D	D	24.9	23.9	8.1	9						
5767	40	4	4	Fb	Fb	1.3	1.3	9.3	9.4	S	S	7.7	7.9	1.6	1.8						
5767	43	4	4	Sw	Sw	1.3	1.3	24.4	24.5	C	C	23.3	21.9	8.3	7						
5767	45	4	4	Sw	Sw	1.3	1.3	15.4	15.4	I	I	14.5	14.1	6.9	7						
5767	55	5	5	Sw	Sw	1.3	1.3	15.4	15.3	I	I	15.5	15.5	6.7	6	11	11	12	12		
5767	65	6	6	Sw	Sw	1.3	1.3	17.1	17.2	C	C	20	19.4	12.6	12.8						
5767	70	7	7	Aw	Pb	1.3	1.3	12.4	12.4	x	S	n/a	8.8	n/a	5.2	4	19		9		
5767	72	7	7	Sw	Sw	1.3	1.3	26	26	C	C	21	20.7	7.9	8.9	19	19				
5767	75	8	8	Sw	Sw	1.3	1.3	19.9	20	C		21.2	20.6	5.2	19	19					
5767	80	8	8	Sw	Sw	1.2	1.2	24.1	24	C	C	20.2	19.2	10.7	10	11	11	19	19		
5768	2	1		Sw	Sb	1.3		18.5		I		16.2		2.7							
5768	5	1		Pl	Pl	1.3	1.3	28	28	D	C	20.2	19.6	13.2	14.8						
5768	9	1		Sw	Sb	1.3		13.3		S		14.5		2.1							
5768	10	1		Pl	Pl	1.3	1.3	17.9	18.1	C	C	17.5	16.2	12.4	13.1						
5768	13	1		Sw	Sb	1.3		15.8		I		15.8		2.6							
5768	14	1		Sw	Sb	1.3		12.8		I		13.9		1.7							
5768	15	1		Pl	Pl	1.3	1.3	15	15.2	C	C	15.2	15.3	12.5	13		11				
5768	20	2		Pl	Pl	1.3	1.3	24.5	24.7	D	C	18.5	18.3	14.8	15						
5768	25	3		Sw	Sb	1.3	1.3	9.9	10.1	S	S	9.1	9	4.4	4.8						
5768	28	4		Sw	Sb	1.3		29.4		D		21		3		12					
5768	30	4		Pl	Pl	1.3	1.3	13.3	13.4	C	C	16.7	17.3	13.1	12.1	12	18				
5768	35	4		Pl	Sb	1.3	1.3	28.7	28.6	S	X	8.7	8.7	2.8	3	8	8		9		
5768	40	5		Pl	Pl	1.3	1.3	14.6	14.6	C	C	17.5	17.3	12.7	13.8		18				
5768	45	5		Pl	Pl	1.3	1.3	11.8	12	x		n/a		n/a		4	4				
5768	47	5		Sw	Sb	1.3		11.1		I		12.6		3.6							
5768	48	5		Sw	Sb	1.3		10.6		I		10.5		3.6							
5768	50	5	5	Sw	Sw	1.3	1.3	17.4	17.3	I	I	15.9	14.4	5.8	7.7						
5768	55	6		Pl	Pl	1.3	1.3	18.3	18.5	I	C	17.1	17	12.3	12.2						
5768	60	6		Pl	Pl	1.3	1.3	21.6	21.5	C	C	19	19.1	14.1	14.4						
5768	65	6		Pl	Sb	1.3	1.3	28.6	28.4	C	D	19	22.9	3.2	9.8	12					
5768	70	6		Sw	Pl	1.3	1.3	16.4	16.1	s		14.9		6.4							
5768	71	8		Pl	pl	1.3	1.3	14.8	14.7	C	c	18.9	19.3	13.1	13.1	26	26				
5774	6	3	3	Sw	SW	1.3	1.3	15.7	15.7	I	I	16.4	16.9	9.4	10.9	11	11				
5774	16	3	3	Pb	PB	1.3	1.3	29.8	29.8	C	C	22.9	22.8	17.5	17.1	11	11				
5774	26	4	4	Sw	SW	1.3	1.3	15.4	15.1	I	I	17	15.7	10.1	11.1						
5774	36	5	5	Sw	SW	1.3	1.3	12.3	12.1	X	X					5	5				
5774	47	6	6	Sw	SW	1.3	1.3	9.2	9.1	X	S		15.3		12.8	4					
5774	56	6	6	Sw	SW	1.3	1.3	12.8	12.6	I	I	16.8	18.2	10.2	9.6	12	12	11			
5774	67	8	8	Sw	SW	1.3	1.3	31.1	30.7	C	D	25.9	27.1	14.5	16.2						
5774	72	8	8	Sw	SW	1.3	1.3	22.5	22.2	C	C	20	19	9.5	8.3						
5777	1	6	6	Pb	PB	1.3	1.3	30.4	30.5	D	C	18.7	19.2	9.9	9	11	11				
5781	2	1	1	Aw	AW	1.3	1.3	25.6	25.6	C	C	24.5	23.4	17.8	17.3	11	11				
5781	13	4	4	Sw	SW	1.3	1.3	39.6	39.5	C	C	26.5	27.3	13.7	12	11	11				
5781	22	7	7	Aw	AW	1.3	1.3	30.9	31.1	C	C	26.9	25	20.3	17.2	11					
5781	31	8	8	Aw	sw	1.3	1.3	19.5	19.4	C	C	23.3	19.6	18	6.4	11					
5784	6	2	2	Aw	AW	1.3	1.3	34.5	34.5	C	C	20.2	21.6	13.5	13.6	10	10		19		15
5784	17	4	4	Aw	AW	1.3	1.3	17.7	17.7	C	C	21	22.1	17.1	14.3	11	11				
5784	26	5	5	Aw	AW	1.3	1.3	18.8	18.6	C	C	20.5	19.7	12.6	12.4						

PLOT NUMBER	TREE NUMBER	SECTION		TREE SPECIES		BREAST HEIGHT (m)		DBH (cm)		CROWN CLASS		TREE HEIGHT (m)		HEIGHT TO CROWN		CC1		CC2		CC3	
		Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit
5784	37	8	8	Aw	AW	1.3	1.3	24.6	24.6	C	C	22.6	23.7	16	16.9	10	10	11	11		
5787	4	2	2	Sb	Sb	1.3	1.3	18.1	18	I	I	17	17.4	8.1	5.4						
5787	14	3	3	Pb	Pb	1.3	1.3	18.5	18.2	I	I	14.8	17	10.8	10.5	11	11	22			
5787	24	5	5	Sw	Sw	1.3	1.3	21.6	21.7	C	C	24.8	24.2	13.1	12.5	12	12				
5787	34	6	6	Aw	Aw	1.3	1.3	21.7	21.4	C	C	21.1	22.3	15.7	14.5	11	11				
5787	44	7	7	Aw	Aw	1.3	1.3	19.2	18.9	I	I	18.6	13.8	13.7	10.5	12	12	15	15		
5787	54	8	8	Sb	Sb	1.3	1.3	15.6	15.6	I	I	13	13	2.9	3						
5791	4	2	2	Sw	Sw	1.3	1.3	34.4	34.2	C	C	19	18.6	3.8	3.6	11		10	10		
5791	6	3		Sw	Sw	1.3	1.3	33.9	33.6	C	C	20	19.9	3.4	3						
5791	12	6	6	Sw	Sw	1.3	1.3	28.2	28	I	I	14	14.1	2	2	11	11				
5791	16	8	8	Sw	Sw	1.3	1.3	23.3	23.4	I	I	13.3	13.2	3.4	2.7	10	10				
5792	2	2	2	Aw	AW	1.3	1.3	18.7	18.7	C	C	13.2	13.6	3.3	2.8						
5792	3	2	2	Aw	AW	1.3	1.3	18.1	18.2	C	C	14	14	3.5	3.3	11	11				
5792	4	2	2	Pb	PB	1.3	1.3	14.1	14.3	C	C	11.1	11.4	2.2	2.2						
5792	5	2	2	Aw	AW	1.3	1.3	13.6	13.5	C	C	11.4	11.8	4.4	3.6	11	11				
5792	9	6	6	Bw	BW	1.3	1.3	9.9	10	I	I	7.1	7	3.4	2.8		16				
5794	1	1	1	Aw	Aw	1.3	1.2	28.2	28.4	C	C	20.7	20.6	8	8.4	11					
5794	4	1	1	Pb	Pb	1.3	1.2	15.4	15.6	C	C	18.1	17.9	11.2	8.7	11	11		19		
5794	11	2	2	Aw	Aw	1.3	1.2	23.3	23.4	C	C	19.3	20.5	10.1	11	13		11	11		
5794	12	2	2	Aw	Pb	1.3	1.2	18.7	17.8	C	C	17.9	18.7	11.4	10.2						
5794	21	4	4	Bw	Bw	1.3	1.2	14.3	14.3	I	I	15.1	15.5	10.4	9.7		11				
5794	22	4	4	Bw	Bw	1.3	1.2	19.1	19.3	C	C	17.5	17.7	7.6	7.5	11	11		19		
5794	29	7	7	Bw	Bw	1.3	1.2	29.2	29.3	C	C	18.2	17.6	8	7.5	10	10				
5801	3	1	1	Pb	Pb	1.3	1.3	26.7	26.7	C	C	20.8	20.2	11.7	9.6	18	19				
5801	13	3	3	Pb	Pb	1.3	1.2	14.8	14.7	I	I	16.3	16.2	11.4	10.3	12	12	11	11		
5801	23	5	5	Aw	Aw	1.3	1.3	26.7	26.6	C	C	20.4	21.8	9.5	10	11					
5801	33	7	7	Aw	Aw	1.3	1.2	21.1	21	C	C	21	20.7	11.1	10.8	11					
5801	38	8	8	Aw	Aw	1.3	1.2	26.5	26.9	C	C	21.1	20.5	10.9	10.6	10		11	11		
5801	9998	8	8	Aw	Aw	1.3	1.3	23.4	23.1	C	C	23	22.3	13.8	12.7						
5801	9999	8	8	Sw	Sw	1.3	1.3	21.8	21.8	I	I	13.5	13.1	5.5	3	11	11				
5804	4	1	1	Pb	Pb	1.3	1.2	17.4	17.4	C	C	19.4	18.6	11.2	9.5						
5804	14	2	2	Sw	Sw	1.3	1.2	12.7	12.7	I	I	14.8	14.7	7.5	3.5	9					
5804	24	2	2	Bw	Bw	1.3	1.3	14	13.9	I	I	14.7	13.9	6.4	6.5	11	11				
5804	35	3	3	Bw	Bw	1.3	1.3	10.5	10.5	I	I	14.3	13.9	5.1	6.2	11	11				
5804	45	5	5	Bw	Bw	1.3	1.1	13.7	13.7	C	C	15.9	15.9	10	8.9	11	11	18	18	14	14
5804	54	6	6	Sw	Sw	1.3	1.3	11.9	11.6	I	I	15	14.2	8	5.9	12					
5804	64	7	7	Sw	Sw	1.3	1.2	15.1	15.1	C	C	17.1	16.4	7.5	8						
5804	74	8	8	Sw	Sw	1.3	1.2	9.5	9.5	S	S	11.8	11.4	4.7	4.2	11					
5804	81	8	8	Bw	Bw	1.3	1.2	11.5	11.7	I	I	15.3	14.9	7.9	7.9	11	11	12			
5804	9998	3	3	Sw	Sw	1.3	1.3	23.8	23.7	C	C	19.1	18.8	8.3	7.7						
5804	9999	7	7	Sw	Sw	1.3	1.3	24.8	24.8	D	C	23.4	22.5	12.1	11.8						
5805	3	1	1	PL	PL	1.3	1.35	19.8	20	C	C	22.6	21.9	15.1	12.9	19	19	11	11		
5805	9	2	2	PL	PL	1.3	1.3	25.3	25.3	I	C	17.4	17.1	5.7	4.9						
5805	13	3	3	PL	pl	1.3	1.3	22.7	22.4	C	c	19.4	18.5	11.4	8.7						
5805	23	5	5	PL	pl	1.3	1.3	20.9	21	C	c	19.7	19.4	11.7	9.3						
5805	33	7	7	PL	pl	1.3	1.3	19.4	19.6	C	c	20.3	18.3	12.6	10.4						
5805	34	7	7	PL	pl	1.3	1.3	20.2	20.3				18.3			04	04				
5807	1	1	1	Pl	PL	1.3	1.3	20.8	20.6	C	C	21.2	20.8	11.1	10.4	18	18	19	19	16	16
5807	2	1	1	Pl	PL	1.3	1.3	19.8	19.8	D	D	23.7	22.8	10.4	10.7						
5807	5	2	2	Pl	PL	1.3	1.3	23.6	23.8	C	C	21.5	21	15	12.2						
5807	7	3	3	Sw	PL	1.3	1.3	19.6	19.8	C	C	21.1	20.3	13.3	10.9						
5807	15	5	5	Pl	PL	1.3	1.3	24.5	24.5	C	C	23.7	22.1	17	16.5						
5807	25	7	7	Pl	PL	1.3	1.3	23.5	24.5	C	C	23.5	22.4	14.1	12.5						
5807	26	7	7	Pl	PL	1.3	1.3	17.3	17.4	C	C	20.5	19.8	15.7	13.2	11	11	12	12		
5807	31	8	8	Pl	PL	1.3	1.3	19.6	19.7	C	C	21.4	20.1	13	11.2						
6024	3	1	1	Aw	Aw	1.3	1.3	15.8	15.8	C	C	20.2	19.9	13.9	13.7	5	5	18	18		
6024	13	2	2	Aw	Aw	1.3	1.3	9.5	9.5	S	S	12.8	12.8	10.1	10	11	11				
6024	23	3	3	Aw	Aw	1.3	1.3	11.7	11.6	C	C	18.2	18.5	13.6	13.4	11	11				
6024	33	4	4	Aw	Aw	1.3	1.3	11.5	11.5	S	S	10.3	10.3	6.4	6.4	18	18	12	12		
6024	43	6	6	Aw	Aw	1.3	1.3	17.2	17.1	I	I	16.5	16.9	9.6	9	11	11	12	12		
6024	53	7	7	Aw	Aw	1.3	1.2	16.2	16.4	C	C	21.7	22.2	15.8	15	11	11				
6024	61	8	8	Aw	Aw	1.3	1.3	12.2	11.9	C	C	21.3	22.3	15	15						
6024	62	8	8	Aw	Aw	1.3	1.3	11.1	11.1	C	C	19.7	18.5	15.2	15.2	11	11				
6030	5	3	3	SW	Sw	1.3		45.8	45.7	D	D	30.9	31.1	8.1		11	11				
6030	10	4	4	SW	Sw	1.3		15.9	16.1	I	I	16.9	16.4	4.7		11					
6030	15	5	5	SW	Sw	1.3		33.8	33.9							5	5				
6030	20	8	8	PB	Pb	1.3		15.2	15.4	S	I	10.1	9.9	7.3		10		11		12	12
6030	2301	4	4	SW	Sw	1.3		33.5	33.2	C	C	27.8	27.3	15.9		11	11	12	12		
6032	2	1	1	AW	Aw	1.3		22	22.1		C		13.3		12.7	5	5				
6032	4	2	2	AW	Aw	1.3		52	50.6	C	C	23.6	24.1	15.2	14.7	10	10	11	11	19	
6032	8	7	7	SW	Sw	1.3		58.4	58.5	D	D	32.1	32.4	4.8	5	11	11				
6032	2201	2	2	SW	Sw	1.3		35.4	35.7	C	C	19	19.6	2.5	2.7	11	11	22	22		
6033	2	1	1	Aw	Aw	1.3	1.3	10.8	10.8	C	C	17.8	15.2	12.7	12.7	12	12	20	20		
6033	12	1	1	Aw	Aw	1.3	1.3	13	13	C	C	18.4	18.5	11.3	11.3	11	11				
6033	22	2	2	Aw	Aw	1.3	1.3	11.3	11.9	C	C	20.1	18.4	13.1	13.1	19	9	11	11		
6033	32	4	4	Aw	Aw	1.3	1.3	13.2	13.2	I	I	17.3	16.9	11.8	11.7	11	11				
6033	42	3	3	Aw	Aw	1.3	1.3	15.1	15	C	C	21	19.6	12.1	12	11	11				

PLOT NUMBER	TREE NUMBER	SECTION		TREE SPECIES		BREAST HEIGHT (m)		DBH (cm)		CROWN CLASS		TREE HEIGHT (m)		HEIGHT TO CROWN		CC1		CC2		CC3	
		Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit
6033	52	3	3	Aw	Aw	1.3	1.4	9.3	9.3	I	I	15	15.1	9.5	9.4	11	11				
6033	62	5	5	Aw	Aw	1.3	1.3	12.2	12.2	C	C	21.9	17.1	14.1	13.8	11	11	18	18		
6033	72	6	6	Aw	Aw	1.3	1.3	14.2	14.3	C	C	21.3	20.6	13.9	13	11	11				
6033	81	7	7	Aw	Aw	1.3	1.3	9.3	9.4	I	I	16.9	16.9	12.4	12	11	11				
6033	92	7	7	Aw	Aw	1.3	1.3	11.1	11.7	I	I	15.7	15.9	10.8	10.4	11	11				
6033	98	8	8	Aw	Aw	1.3	1.3	13.9	14	C	C	18.1	19.9	12.3	12	11	11				
6039	1	2	2	Pb	Pb	1.3	1.3	10.2	10.8	C	C	9.6	9.8	1.8	1.9						
6039	2	3	2	Pb	Pb	1.3	1.3	10	10.8	C	C	9.1	9.2	1.5	1.6	11					
6039	3	5	5	Pb	Pb	1.3	1.2	10.9	11.6	C	C	9.2	9.6	3.3	1.9	11					
6039	4	7	7	Pb	Pb	1.3	1.3	17.8	19	C	C	12.9	13.2	5.6	4.2	10	10	11			
6039	5	7	7	Pb	Pb	1.3	1.2	10.9	10.8	C	C	9.2	9.4	2.3	1.9	11	11				
6050	4	2	2	SB	Sb	1.3		14.6	15	C	C	14.6	14.9	7.1	10.5	11	11	18	18		
6050	14	2	2	SB	Sb	1.3		19.3	19.5	C	C	17.4	17.3	7.1	10	11					
6050	24	3	3	sb	Sb	1.3		17.9	18.3	C	C	15.9	16.2	9.3	9.8	11					
6050	34	4	4	sb	Sb	1.3		15.8	15.9	C	C	16.2	16.3	10.3	12.2	11	11				
6050	44	4		sb	Sb	1.3		12.5	12.7	C	C	13.9		9.9		11					
6050	54	5	5	sb	Sb	1.3		12.2	12.2							4	4				
6050	64	6	6	sb	Sb	1.3		13.2	13.4	C	C	14.6	14.9	8.6	8.6						
6050	74	7	7	sb	Sb	1.3		11.5	11.7	I	I	11.7	11.8	7.6	7.2						
6050	84	8	8	sb	Sb	1.3		16	16.2	C	C	16	16	11	9.6	17	17				
6050	91	8	8	sb	Sb	1.3		14	14.3	C	C	14	13.9	8.6	7.3	11	11				
6050	2301	4		sb		1.3		13.4		C		14.9	14.4	9.3	10.6	11	11				
6051	3	1	1	Pb	Pb	1.3		39.1	39.1	C	C	23.7	23.9	15.4	14.8	10	11				
6051	13	2	2	PB	Pb	1.3		15.2	15.3	I	I	12.6	11.8	9.2		9	9	11	10		
6051	23	5	5	PB	Pb	1.3		30.8	31.1	C	C	19.6	18.9	13.2	10.4	10	10	11	11		
6051	33	7	7	pb	Pb	1.3		30.3	30.4	C	C	20.8	20.8	16.7	16.4	11		12	12		
6051	43	8	8	pb	Pb	1.3		25.5	25.6	C	C	21	21.2	14.8	15.6	11					
6051	46	8	8	sw	Sw	1.3		14.9	15.1	I	I	11.8	11.9	2	3.2	11					
6053	1	1	1	Pj	Pj	1.3	1.3	18.1	17.9	C	C	21	21.6	15.9	15						
6053	20	4	4	Pj	Pj	1.3	1.3	20.2	20.4	X	X					5					
6053	23	4	4	Pj	Pj	1.3	1.3	13.1	13.2	C	C	17.9	18	12.7	13						
6053	30	4	4	Pj	Pj	1.3	1.3	13.5	13.6	I	I	16.5	16.3	12.2	12						
6053	40	7	7	Pj	Pj	1.3	1.3	30.9	30.9	D	D	23.8	24.2	14.7	15						
6053	49	8	8	Pj	Pj	1.3	1.3	19.9	19.9	C	C	21.4	21.6	14.6	15						
6053	2201	2	2	Pj	Pj	1.3	1.3	17.6	17.6	C	C	19.4	20	14.2	14						
6055	3	1	1	Aw	Aw	1.3		14.7	14.7	C	C	18.2	18.7	7.9	9.5		11				
6055	13	4	4	Aw	Aw	1.3		10.4	10.3	I		11.5	11.4	7.5	7.5		11				
6055	23	5	5	Pl	Pj	1.3		32.7	32.4	C	C	19.8	19.7	9.6	9.6	12	12				
6055	26	6	6	Sb	Sb	1.3		12.6	12.6	S	I	10.7	10.6	1.3	1.2						
6055	32	7	7	Aw	Aw	1.3		16.1	16.2	C	C	15.5	15.4	9	8.1		10				
6055	2201	2	2	Aw	Aw	1.3		24.1	24.2	D	D	22.6	21.7	8	8.1						
6055	2301	5	5	Aw	Aw	1.3		28.2	28.1	C	C	21.1	21.1	10.1	10.8						
6056	1	1	1	Pj	Pj	1.3	1.3	21	20.8	C	C	15.4	15.6	8.9	9						
6056	4	3	3	Sw	Sw	1.3	1.3	9.9	9.9	I	I	9.6	9.7	1	1						
6056	9	5	5	Pj	Pj	1.3	1.3	13.9	14.1	I	I	14.5	14.6	10.1	10						
6056	13	6	6	Pj	Pj	1.3	1.3	23.4	23.4	D	D	21.7	21.8	12.4	12						
6056	19	8	8	Pj	Pj	1.3	1.3	34.2	34.2	C	C	17.9	17.4	10.2	10	12	12				
6063	5	1	1	Aw	Aw	1.3	1.3	26.6	26.6	C	C	21.4	20.9	14.7	14						
6063	10	2	2	Aw	Aw	1.3	1.3	18.6	18.6	I	I	17.5	17.4	11.7	11						
6063	25	7	7	Aw	Aw	1.3	1.2	23.8	23.9	C	C	24.8	25.2	16.3	16						
6063	30	8	8	Aw	Aw	1.3	1.2	11	10.4	I	I	13.6	14	11.2	11						
6063	2301	5	5	Aw	Aw	1.3	1.3	22.8	22.9	C	C	20.6	21.2	13.4	13	10	10				
6064	4	1	1	Aw	Aw	1.3	1.3	22.8	22.9	C	C	26.2	26.2	20.7	20						
6064	14	4	4	Aw	Aw	1.3	1.3	17.5	17.5	C	C	23.9	23.6	15.3	15						
6064	24	5	5	Aw	Aw	1.3	1.3	12.7	12.8	I	I	17.6	17.2	13.5	13	17	17				
6064	34	7	7	Aw	Aw	1.3	1.2	19.2	19.2	C	C	27.2	26.8	17.4	17						
6064	43	8	8	Aw	Aw	1.3	1.3	14.5	14.6	I	I	21	21.5	14.3	14						
6066	1	1	1	Sw	Sw	1.3	1.3	36.6	36.4	C	C	23	22.8	4.4	4.2						
6066	2	1	1	Pb	Pb	1.3	1.2	11	11.1	I	I	12.3	12.4	5.7	6	19	19				
6066	3	3	3	Sw	Sw	1.3	1.3	12.7	12.7	I	I	10.9	11.1	3.1	3						
6066	4	5	5	Sw	Sw	1.3	1.3	10.1	10.3	I	I	8.8	9.1	1	1.2						
6066	5	5	5	Sw	Sw	1.3	1.2	15.6	15.5	I	I	12.6	12.6	3.3	3.2						
6069	1	5	5	Aw	Aw	1.3		9.5	9.5	C	C	12.3	12.1	5	5	19	11				
6069	5	5	5	Aw	Aw	1.3		9.3	9.4	C	C	12.1	12.1	4.2	5.1	11	11				
6069	10	6	6	Aw	Aw	1.3		9.4	9.5	C	C	12.5	12.5	3.9	6.8	18		11	11		10
6069	2301	5	5	Aw	Aw	1.3		11.1	11.1	C	C	13.2	13.4	4.9	5	19	11				
6069	2401	6	6	Aw	Aw	1.3		9.2	9.2	C	C	12	11.9	4.4	4.6	19	19				
6070	1	1	1	Sb	Sb	1.3	1.3	10.4	10.5	C	C	7.3	7.3	2.2	2.2						
6070	2	1	1	Sb	Sb	1.3	1.3	11.4	11.6	C	C	7	7.2	2.8	2.5						
6070	9	4	4	Sb	Sb	1.3	1.3	12.7	12.6	C	C	8.8	9.4	3.3	3						
6070	2301	4	4	Sb	Sb	1.3	1.3	9.2	9.2	C	C	6.4	6.7	2.6	2.5						
6070	2401	7	7	Sb	Sb	1.3	1.3	9.8	9.8	C	C	6.2	6.2	1.8	1.5	10	10				
6071	1	1	1	Pj	Pl	1.3	1.3	21	20.8	C	C	15.8	16.2	8.1	8.1	10	10	18	18		
6071	9	2	2	Aw	Aw	1.3	1.3	9.5	9.4	I	I	10.3	10.7	7.8	7.5	19	19				
6071	19	3	3	Aw	Aw	1.3	1.3	13.6	13.5	C	C	16.4	16.3	12.1	12	19	19				
6071	29	4	4	Aw	Aw	1.3	1.3	27.7	27.6	C	C	17.6	17.7	10.2	10	18	18	19	19		
6071	39	7	7	Pl	Pl	1.3	1.3	15.9	15.7	C	C	16.1	16.3	9.8	9						

PLOT NUMBER	TREE NUMBER	SECTION		TREE SPECIES		BREAST HEIGHT (m)		DBH (cm)		CROWN CLASS		TREE HEIGHT (m)		HEIGHT TO CROWN		CC1		CC2		CC3	
		Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit
6071	49	8	8	Sb	Sb	1.3	1.3	15.4	15.9	I	I	13.1	13.4	4.5	4.5						
6071	50	8	8	Pl	Pl	1.3	1.3	24.4	24.4	C	C	18	18.4	9.2	9	19	19				
6073	1	1		Aw	Aw	0.4	0.4	16.1	16.2	X	X					6					
6073	10	2	2	Aw	Aw	0.3	0.3	9.4	9.6	X	X					6	6				
6073	20	3	3	Aw	Aw	0.2		19	19.1	X	X					6	6				
6073	28	4	4	Aw	Aw	0.2	0.2	12.5	12.6	X	X					6	6				
6073	40	5	5	Aw	Aw	0.2	0.2	13.4	13.5	X	X					6	6				
6073	43	5	5	Aw	Aw	1.3		14.4	14.1	C	C	16.4	16.3	11	10.2		18				
6073	2401	6	6	Aw	Aw	1.3		15.1	15	C	C	21.1	19.8	12	10.4						
6074	3	1	1	Aw	Aw	1.3	1.3	15	15	I	I	17.9	17.8	15.7	15						
6074	13	2	2	Aw	Aw	1.3	1.3	14.8	14.7	C	C	19.3	19.7	14.5	14						
6074	23	3	3	Aw	Aw	1.3	1.3	16.1	16	C	C	21.6	22.1	14.1	14	19	19				
6074	33	4	4	Aw		1.3	1.3	13.8	14	C	C	20.8	21.3	16.3	16						
6074	43	5	5	Aw	Aw	1.3	1.3	10.8	10.7	X	X					4	4				
6074	63	8	8	Aw	Aw	1.3	1.3	21.7	21.7	C	C	20.2	22.3	14.9	15						
6074	2101	8	8	Aw	Aw	1.3	1.3	19.7	19.9	C	C	21.5	22	15							
6074	2401	6	6	Aw	Aw	1.3	1.3	20.9	20.9	C	C	21.8	22.3	15.5	15						
6076	4	1	1	Aw	Aw	1.3		21.1	20.8	S		11.5	9.3	6	7.5	8	5		7		
6076	5	2	2	Aw	Aw	1.3		23.7	43.3	X	X					5	5				
6076	10	4	4	Aw	Aw	1.3		37.8	37.6	C	C	26.9	25.7	15	14.9	11	11		10		
6076	20	5	5	Aw	Aw	1.3		40.4	40.7	C		24.5	26.4	13.9	12.5		10				
6076	24	7	7	Pb	Pb	1.3		36.9	36.6	C		23.9	24.1	12	11.8		10				
6087	1	1	1	Aw	Aw	1.3	1.3	23.6	23.9	C	C	23	22.9	14.1	14		12				
6087	11	2	2	Aw	Aw	1.3	1.3	13.8	13.9	I	I	15.3	15.9	11.1	11.7						
6087	21	5	5	Aw	Aw	1.3	1.3	9.7	10	I	I	13.6	14	10.7	11						
6087	31	5	5	Aw	Aw	1.3	1.3	11.3	11.6	I	I	18.4	19.7	13.1	13.7						
6087	41	8	8	Aw	Aw	1.3	1.3	19.2	19.4	C	C	21.2	21	15.4	13.8						
6087	45	8	8	Aw	Aw	1.3	1.3	13.1	13.1	I	C	19.1	19.1	15.9	14.1						
6088	1	6	7	Pb	Pb	1.3	1.3	35.4	35.6	C	C	18.5	19	7.9	7						
6089	2	1	1	Aw	Aw	1.3	1.3	32.9	33	D	D	30.5	32.9	24.9	23.8	15	15				
6089	12	4	3	Sw	Sw	1.3	1.1	11.3	11.4	S	S	9.9	10.2	3.4	1.6						
6089	22	6	6	Aw	Aw	1.3	1.3	23.1	23.1	C	C	26.5	26.7	22.4	22.6						
6089	31	8	7	Aw	Aw	1.3	1.3	33.1	33.3							5	5				
6092	3	1	1	Pb	Pb	1.3		17.5	17.5	C	C	16	16	9.8	10.5	18	18				
6092	7	1	1	Aw	Aw	1.3		9.8	9.6	I	I	12.3	12.2	9.5	8.4						
6092	12	2		Pb	Pb	1.3		17.7	17.5	C	C	16.4	16.4	10.4	8.9						
6092	17	4	4	Pb	Pb	1.3		22.9	23.1	S	S	6.6	6.6	4.2	4.2	9	9	17	17	7	7
6092	22	7	7	Sw	Sw	1.3		10.7	10.7	I	I	9.4	9.3	1.6	1.5						
6092	29	8	8	Aw	Aw	1.3		21.1	20.8	C	C	18.5	18.9	11	10.7						
6098	2	1	1	Aw	Aw	1.3		11.4	11.2	X						4	4				
6098	6	1	1	Aw	Aw	1.3	1.3	22.2	22.1	C	C	21.4	21.2	16.8	15						
6098	11	2	2	Pb	Pb	1.3		11.7	11.9	I	I	15.4	15.7	9	9	19					
6098	16	3	3	Aw	Pb	1.3		11.3	11.6	I	I	15	15.5	10.4	10.5						
6098	21	4	4	Pb	pb	1.3		12.7	12.5	S	S	9.8	9.8	5	6.5	11	11	18	18	12	12
6098	26	5	5	Aw	Pb	1.3		13.5	13.8	X						4	4				
6098	31	5	5	Pb	Pb	1.3	1.3	13	13	I	I	16.8	15.7	11.5	7.8						
6098	36	7	7	Aw	Aw	1.3	1.3	9.2	9.3	I	I	12.9	12.6	8.3	8						
6098	41	8	8	Aw	Pb	1.3		9.1	9.1	X						4	4				
6098	46	8	8	Aw	Aw	1.3		9.2	9.2	S	S	9.5	9.6	7.8	6.1						
6098	48	8	8	Aw	Aw	1.3		22.1	22.2	C	C	21.4	21.8	13.4	12.4	19					
6101	1	3	3	Pb	Pb	1.3	1.3	27.2	27.4	C	C	21.5	21.3	14.7	15						
6101	8	3	3	Pb	Pb	1.3	1.3	27.9	27.9	C	C	22.4	22.5	17.7	18	10	10				
6101	15	5	5	Aw	Aw	1.3	1.3	29.9	30	C	C	24.7	24.3	17.4	17						
6101	26	6	6	Aw	Aw	1.3	1.3	15.8	15.8	C	C	21.1	21.5	16.4							
6101	35	8	8	Aw	Aw	1.3	1.3	40.9	40.7	C	C	26.1	25.6	16.5	17						
6102	1	1		Sw	Sw	1.3	1.2	10.9	10.9	I	I	11.2	11.4	6.9	7.3	11					
6102	11	3		Pb	Pb	1.3	1.3	13.9	13.9	I	I	13.6	13.6	10.4	9.2	10	10	11			
6102	21	4		Bw	Bw	1.3	1.3	10.1	10.1	I	I	14.3	14.6	8.2	8.1	10	10				
6102	31	5		Bw	Bw	1.3	1.3	12.8	12.9	C	C	16.2	16.6	11.2	11	10	10	11			
6102	41	6		Sw	Sw	1.3	1.3	10	9.9	S	S	10.4	10.3	5.2	5.3						
6102	51	6		Sw	Sw	1.3	1.3	10.5	10.5	I	I	13.2	13.5	8.9	9.1	11					
6102	61	8		Sw	Sw	1.3	1.3	15.7	15.8	I	I	15.7	16	8.8	8.1	11					
6102	2402	6		Sw	Sw	1.3	1.3	9.3	9.2	S	S	10.8	10.7	6.7	5.9						
6104	1	4	4	Fb	Fb	1.3	1.3	11.2	11.2	S	I	9.9	10.1	2.1	1.7						
6104	2	4	4	Sw	Sw	1.3	1.3	29.2	29.4	I	S	18	17.8	7.4	3						
6104	3	5	5	Sw	Sw	1.3	1.3	51.7	52	C	C	30.2	29.8	18.3	17						
6104	4	5	5	Fb	Fb	1.3		13.6	13.5	S	I	12.1	12.1	4.4	3						
6104	5	6	6	Fb	Fb	1.3		29	29.3	I	I	13.8	13.5	4.2	4	11	11	9	9		12
6120	5	1		Pb	Pb	1.3	1.3	29.4	29.5	C	C	26.3	26.4	14.6	17.7						
6120	13	2		Pb	Pb	1.3	1.3	21.1	21.1	C		24.5	23.9	9.4	12.1	11					
6120	23	3		Aw	Aw	1.3	1.3	19.1	19.2	C	C	24.2	23.8	18.9	18	11					
6120	33	5		Aw	Aw	1.3	1.3	20.2	20.3	C	C	23.1	22.5	18.1	19	11		10	10		
6120	45	6		Pb	Pb	1.3	1.3	15.8	15.7	I		17.3	16.7	9.4	10.3	18	18	9	9		
6120	53	7		Pb	Pb	1.3	1.3	19.2	19.3	C	C	22.7	23.4	11.2	12.3						
6120	61	8		Pb	Pb	1.3	1.3	19	19	C	C	24.6	23.9	13	15	11					
6121	2	3		Pl	Pl	1.3	1.3	10.4	10.3	C	C	9.4	9.4	4.2	4.1	11					
6121	12	6		Pl	Pl	1.3	1.3	10	10	C	I	7.8	8	3.9	4.6	11					

PLOT NUMBER	TREE NUMBER	SECTION		TREE SPECIES		BREAST HEIGHT (m)		DBH (cm)		CROWN CLASS		TREE HEIGHT (m)		HEIGHT TO CROWN		CC1		CC2		CC3	
		Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit
6121	15	7		Pl	Pl	1.3	1.3	11.6	11.6	C	C	9.8	9.8	5.4	5.2						
6121	16	8		Pl	Pl	1.3	1.3	13.3	13.4	C	C	10.7	10.4	6.5	5.8						
6121	17	4		Sb	Sb	1.3	1.3	9.7	9.9	C	I	8.1	8	3.3	2.7						
6122	2	1	1	Sb	Sb	1.3	1.3	12.2	12.6	I	I	9.6	10.3	2.7	2.5						
6122	6	1	1	Sw	Sw	1.3	1.3	23.1	22.6	C	C	14.3	14.6	4.9	5						
6122	9	2	2	Sw	Sw	1.3	1.3	22.14	22.1	C	C	14.3	14	2.8	3						
6122	13	8	8	Sw	Sw	1.3	1.3	24.7	25	D	D	16.2	16	4.6	5						
6122	19	8	8	Sw	Sw	1.3	1.3	15.9	15.8	I	I	11.1	11.4	2.5	3						
6128	1	7	7	Sw	Sw	1.3	1.4	25	25.3	D	D	18.2	19	3.3	3						
6128	2	7	7	Sw	Sw	1.3	1.4	13.1	13.2	C	C	11	11.2	6.8	7						
6128	3	7	7	Sw	Sw	1.3	1.4	19.4	19.4	D	D	17.4	17.6	3.6	4						
6128	4	8	8	Sw	Sw	1.3	1.3	10.2	10.5	I	I	8.9	9.1	3.7	4						
6128	2101	8	8	Sw	Sw	1.3	1.3	9.7	9.6	I	I	7.7	7.9	3.1	3						
6136	3	2	2	Pl	Pl	1.3	1.3	11.3	11.3	C	C	7.9	7.8	3.5	3						
6136	13	5	5	Pl	Pl	1.3	1.23	10.6	10.7	C	C	8.7	8.9	4.3	4	11	11	18	18		
6136	17	7	7	Pl	Pl	1.3	1.24	10.2	10.2	C	C	8.5	8.4	3.4	3.4						
6137	4	1	1	Aw	Aw	1.3	1.3	12.3	12.5							4	4				
6137	14	1	1	Sb	Sb	1.3	1.3	9.4	9.4	I	I	9.9	9.9	6	5.7	10	17				
6137	24	3	3	Sb	Sb	1.3	1.3	11.7	11.8	I	I	11.3	11.7	4.9	7.7	11	11				
6137	34	3	3	Sb	Sb	1.3	1.3	16.2	15.5	C	C	14.9	15.3	7.2	7						
6137	44	4	4	Sb	Sb	1.3	1.3	19.6	19.8	C	C	17.5	18.2	7.8	6.8						
6137	54	5	5	Sb	Sb	1.3		12.2	12.3							5	5				
6137	64	6	6	Sb	Sb	1.3	1.3	11.9	12.1	C	C	14.7	15.3	7.4	5.5	10					
6137	74	7	7	Aw	Aw	1.3	1.3	23	20.6	C	C	14.3	14.7	10.8	10.6	15	15				
6137	84	8	8	Sb	Sb	1.3	1.3	19.3	19.3	C	C	15.8	15.9	5.2	5						
6137	94	8	8	Aw	Aw	1.3	1.3	13.5	13.6							5	5				
6147	4	1	1	Aw	Aw	1.3		10.4	10.4	C	C	16	17	12	11.9						
6147	9	2	2	Sb	Sb	1.3		9.2	9.2	I	I	10	10.1	5	4.3						
6147	14	2	2	Sb	Sb	1.3		11	10.9	I	I	11.6	11.7	4.2	4.7						
6147	19	3	3	Aw	Aw	1.3		9.7	9.8	C	C	13.6	14	9.6	8.9						
6147	24	3	3	Sb	Sb	1.3		9.2	9.2	I	I	9.4	9.7	5.8	4.8						
6147	29	4	4	Aw	Aw	1.3		10.6	10.6	I	I	12.9	12.9	10.3	9.5						
6147	34	4	4	Aw	Aw	1.3		9.4	9.4	C	C	13.6	13.6	10.6	9.9	15	15				
6147	44	6	6	Aw	Aw	1.3		9.8	9.7	C	C	15	15	12.3	10.9						
6147	49	6	6	Sw	Sw	1.3		10.4	10.3	I	I	10	10.7	3.5	3.2						
6147	54	7	7	Aw	Pb	1.3		10.1	10.2	C	C	14.6	14.7	11.6	10.9						
6147	59	7	7	Sb	Sb	1.3		10.5	10.5	I	I	9.4	9.6	5.6	3.3						
6147	64	8	8	Aw	Aw	1.3		10.1	10.1	C	C	14.3	14.2	11.8	11.5	19	19				
6147	69	8	8	Sw	Sw	1.3		10.6	10.6	I	I	11.7	11.7	6.8	6.7						
6147	74	8	8	Aw	Aw	1.3		12.3	12.2	C	C	16.1	15.8	12.5	11.4						
6147	2302	5	5	Aw	Aw	1.3		10.1	9.9	C	C	12.2	12.3	9.5	9.6	18	18				
5005	5			AW	Aw	1.3	1.3	17.3	17.3	X	I	17.3	17.5	13.7	10.2	17	17	9	9	1	1
5005	17			PL	Pl	1.3	1.3	20.3	20.4	C	C	20.8	21	12.9	13.9	11	11				
5005	25			PL	Pl	1.3	1.3	17.2	17.3	X	I	17.6	19.2	13.6	13.8	9	9		11		
5005	35			PL	Pl	1.3	1.3	21.8	21.7	I	I	18.7	18.2	10.9	11.8	19	19	11	11		
5005	36			PL	Pl	1.3	1.3	23.8	23.8	C	C	20.2	20.5	13.7	12.9	18	18	19	19		
5006	2			SW	Sw	1.3	1.3	15.6	15.8	I	I	15.8	15.8	7.6	7.6						
5006	12			SW	Sw	1.3	1.3	11.8	12	I	I	14.8	15	7	8.1	11	11				
5006	22			SW	Sw	1.3	1.3	12	12.1	I	I	16.2	16.5	9.8	10.3	11	11				
5006	32			SW	Sw	1.3	1.3	12.9	12.9	I	I	13.2	13.3	7.7	8.2						
5006	42			SW	Sw	1.3	1.3	15.5	15.2	I	I	16.7	16.7	9.8	9.2						
5006	52			SW	Sw	1.3	1.3	19.6	19.9	C	C	21.1	21.9	10.9	10.7	11	11				
5006	62			SW	Sw	1.3	1.3	15.5	15.6	C	C	18.4	18.6	13.6	12.6						
5006	63			SW	Sw	1.3	1.3	35	35.1	D	D	23.4	22.9	13.4	12.5						
5008	2			AW	Aw	1.3	1.3	22.2	22.3	I	C	16	17	8.3	7.8	11	11				
5008	13			PB	Pb	1.3	1.3	13.5	13.5	S	S	11.2	11.4	4.1	4.1	11	11				
5008	22			PB	Pb	1.3	1.3	9.4	9.4	S	S	11.7	11.6	5	5.5						
5008	33			PB	Pb	1.3	1.3	11.3	11.4	S	S	10.1	10.2	6.7	6.1						
5008	34			PB	Pb	1.3	1.3	11.3	11.2	S	S	7.7	7.4	4.7	4.5	19	19	1	1		
5009	1			SW	Sw	1.3	1.3	33	33	C	C	26.8	26.3	5.9	6.2						
5009	11			SB	Sb	1.3	1.3	21.9	21.8	I	I	22.4	21.5	8.6	3.7	11	11		18		
5009	12			SW	Sw	1.3	1.3	57.9	57.8	C	C	34.1	33.5	10.9	4.5						
5015	2			SW	Sw	1.3	1.3	17.6	17.7	I	I	15.8	15.5	7.2	8.8						
5015	12			SW	Sw	1.3	1.3	22	21.8	C	C	19.5	19.1	11.9	10.4						
5015	22			SW	Sb	1.3	1.3	12.1	12.1	S	S	11.1	11	4.3	4.2						
5015	32			PB	Pb	1.3	1.3	9.8	9.6	S	S	10.7	10.5	4.6	4.7						
5015	33			SW	Sw	1.3	1.3	15	15	I	I	13.4	13.1	6.1	3						
5018	1			PL	Pl	1.3	1.3	22.3	22.3	I	I	16.8	17	10	10.1	11	11				
5018	11			PL	Pl	1.3	1.3	25.8	26.9	C	C	21.4	21.5	12.1	11.1	11	11	1	1		
5018	21			AW	Aw	1.3	1.3	26.5	26.7	C	C	22.3	21.9	17.3	15.9	11	11	1			
5018	31			AW	Aw	1.3	1.3	15.6	15.7	I	I	18.4	18.1	14.7	13.5	15	15	18	18	11	11
5018	32			AW	Aw	1.3	1.3	15.7	15.9	X	I	16.5	16.7	14.6	14.9	15	15	18	18	9	9
5038	3			SW	Sw	1.3	1.3	18.5	18.5	I	I	14.4	14.7	4.3	4.7	11	11				
5038	13			SW	Sw	1.3	1.3	24.3	24.4	I	I	17.1	17.4	3.5	3.5						
5038	23			SW	Sw	1.3	1.3	19.1	19.4	I	I	14.2	14	2.8	4.5	11	11				
5038	33			SW	Sw	1.3	1.3	13.5	13.5	I	I	12	12	3.1	3						
5038	34			SW	Sw	1.3	1.3	15.4	15.4	X	X	14.7				5	5				

PLOT NUMBER	TREE NUMBER	SECTION		TREE SPECIES		BREAST HEIGHT (m)		DBH (cm)		CROWN CLASS		TREE HEIGHT (m)		HEIGHT TO CROWN		CC1		CC2		CC3	
		Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit
5051	4			PL	Pl	1.3	1.3	21.6	21.7	C	C	15.4	14.6	9.3	7.3	12	12				
5051	15			PL	Pl	1.3	1.3	16	16.1	C	C	13.4	13.5	10.1	8.7						
5051	16			PL	Pl	1.3	1.3	19.2	19.5	C	C	18.9	19.3	14.1	12.5						
5054	6			SB	Sb	1.3	1.3	11	11	I	C	11.4	11.8	5.5	6.5						
5054	16			SB	Sb	1.3	1.3	9.9	9.9	I	I	10.2	10.2	7.3	7	11	11				
5054	26			SB	Sb	1.3	1.3	12.2	12.2	I	I	11.1	11.3	6.5	6.2						
5054	34			PL		1.3		12.6		X		12.9				5	1				
5054	36			SB	Sb	1.3	1.3	9.7	9.7	I	I	11.3	11.3	8.3	9						
5054	46			SB	Sb	1.3	1.3	9.4	9.5	I	I	11	11.1	6.9	6.9	18	18				
5054	56			SB	Sb	1.3	1.3	10	10	I	I	11	11.1	6.8	7.7						
5054	57			PL	Pl	1.3	1.3	9.5	9.6	I	I	9.5	9.5	7.8	7.7	11	11				
5057	4			AW	Aw	1.3	1.3	29.4	29.6	C	C	25.8	25.1	17.5	16.1	11	11	1	1		
5057	13			AW	Aw	1.3	1.3	24	23.9	C	C	25.5	26	20.4	19.6	19	19	11	11		
5057	23			AW	Aw	1.3	1.3	27.3	27.2	C	C	22.5				19	19	18	18	11	11
5057	25			SW	Sw	1.3	1.3	19.2	19.4	I	I	20.3	20.1	5.4	5						
5057	33			SW	Sw	1.3	1.3	25.7	25.7	I	I	18.5	18.2	2.9	3		1				
5057	34			PB	Pb	1.3	1.3	30.1	30.3	C	C	25.7	25.7	19.4	18.8	18	18				
5061	4			AW	Aw	1.3	1.3	27.5	27.5	C	C	27.8	28.1	20.6	19.5						
5061	14			AW	Aw	1.3	1.3	31.1	31	C	C	28	28.6	22.6	18.5	19	19	11	11	1	1
5061	24			AW	Aw	1.3	1.3	34.5	34.5	C	C	28	27.6	21.1	19.6	19	19	1	1		
5061	35			SB	Sb	1.3	1.3	21.5	21.5	X	S	16.9				4	4				
5061	36			AW	Aw	1.3	1.3	37.4	37.6	C		26.2	26.1	20.2	19.8	15	15	14	14	1	1
5061	44			SW	Sw	1.3	1.3	9.2	9.2	S	S	9.4	9.3	2.6	2.5						
5061	46			AW	Aw	1.3	1.3	27.9	27.9	C	C	26.6	27.1	20.7	19.4	11	11	1	1		
5062	3			AW	AW	1.3	1.3	10.6	10.6	X	S	14.2	13.1	10.3	10.1	9	18	11	11		
5062	13			AW	AW	1.3	1.3	11.8	11.8	X	I	18.5	18.3	14.1	13.6	18	18	9		11	11
5062	21			AW	AW	1.3	1.3	17.2	17.4	C	D	24.7	24.1	17.3	17.2	11					
5062	33			AW	AW	1.3	1.3	16.8	17	C	I	25.5	23.6	15.8	15.4						
5062	42			AW	AW	1.3	1.3	23.2	23.2	C	D	27.1	26.2	16.5	16.8		11		18		
5062	53			AW	AW	1.3	1.3	14.1	14.2	I	S	18.1	16.9	10.4	10.6	18		11	11		
5062	63			AW	AW	1.3	1.3	22.2	22.4	C	D	26.4	27.4	14.8	13.9						
5062	73			AW	AW	1.3	1.3	9.6	9.7	S	S	13.8	13.3	10.9	9.1	18	18	11	12		
5062	83			AW	AW	1.3	1.3	15.3	15.3	I	D	23.3	25.1	16.5	16.3	11					
5063	3			AW	Aw	1.3	1.3	29.3	29.5	C	C	22.3	21.9	17	16	12	12	18	18		
5063	13			AW	Aw	1.3	1.3	26.7	26.6	C	C	20.3	19.7	15.4	13.9		12				
5063	23			AW	Aw	1.3	1.3	23.2	23.3	C	C	21.1	20.6	16.9	14.8	18	18		12		
5063	25			AW	Aw	1.3	1.3	26	25.9	C	C	23.5	23.3	17.7	17.5	18	18				
5064	1			AW	AW	1.3	1.3	14.2	14.5	I	I	16.1	15.6	7.9	8						
5064	11			AW	AW	1.3	1.3	38.3	38.1	C	D	20.4	20.6	12	8.9	15	15	11	13		
5064	18			SB	SB	1.3	1.3	13.1	13	I	S	12.8	13	2	1.8						
5064	31			SB	SB	1.3	1.3	16.5	16.5	I	S	11.4	11.1	5.8	2						
5064	40			AW	AW	1.3	1.3	17.3	17.1	I	C	14.5	14.5	8	5.7	11	11		18		12
5064	41			AW	AW	1.3	1.3	12.4	12.5	X		13.8		7.3		9	8	11			
5065	2			AW	AW	1.3	1.3	24.6	24.7	C	D	23.5	22.6	17.3	14.1	11	11				
5065	11			AW	AW	1.3	1.3	30.3	30.3	C	D	26.6	25.6	21.3	14.3	11	11		12		
5065	22			AW	AW	1.3	1.3	16.1	16.2	X	I	17.5	19.8		13.3	4	4		1		
5065	31			SW	SW	1.3	1.3	34.3	34.4	I	I	20.2	19.5	2.3	1.5						
5065	41			AW	AW	1.3	1.3	17.9	18	X	I	20.6	20.2	16.5	12.9	9	1	11	11		
5072	1			SW	Sw	1.3	1.3	42.9	42.9	C	C	34.5	35.1	5.8	6		11				
5072	10			SW	Sw	1.3	1.3	32.5	32.5	C	C	29.5	30	4.8	4.5						
5072	16			SW	Sw	1.3	1.3	17	16.9	S	S	17.5	17	6	3						
5075	5			SW	Sw	1.3	1.3	19.1	19.2	I	I	16.7	16.4	5.1	6.2	11	11				
5075	14			SW	Sw	1.3	1.3	13.9	13.9	I	I	18.3	17.8	8.1	7.8						
5075	25			SW	Sw	1.3	1.3	21.7	21.7	I	I	18	17.6	4.9	4.3						
5075	26			PB	Pb	1.3	1.3	23.1	23.3	I	I	20.9	21.2	14.4	12.9	14	14				
5087	7			PB	Pb	1.3	1.3	21	20.8	C	C	19.5	19.1	14	13	11	11				
5087	17			BW	Bw	1.3	1.3	10.5	10.4	S	S	5.8	5.4	5.1	5.2	11	11	12	12		
5087	27			SB	Sb	1.3	1.3	20.9	20.9	C	C	18.3	17.7	2.9	2.5	1	1				
5087	37			SB	Sb	1.3	1.3	17	16.9	I	I	14.5	14.3	5.5	3						
5087	47			SB	Sb	1.3	1.3	15.3	15.2	I	I	13.5	13.5	5.2	5						
5087	48			AW	Aw	1.3	1.3	13.3	13.3	C	C	16.3	16.1	12.7	12.4	11	11				
5091	2			SW		1.3	1.3	46	46.1	C	C	31.2	30.4	17.8	15						
5091	12			SW	Sw	1.3	1.3	36.7	36.7	I	C	25.5	25.7	4.9	4.6						
5091	22			SW	Sw	1.3	1.3	15.8	15.8	I	I	17.9	17.2	6.5	4						
5091	23			AW	Aw	1.3	1.3	29.3	29.5	I	I	22.9	23.7	18	18	15	15	11	11		
5094	3			AW	AW	1.3	1.3	25.7	25.5	C	C	21.8	21.8	16.5	15		11		12		
5094	13			AW	AW	1.3	1.3	25.8	25.7	C	C	22.8	23.2	14.2	15.9	12	12				
5094	23			SW	SW	1.3	1.3	22.2	22.3	I	I	18	17.7	9.8	9.5	1	1				
5094	33			SB	SB	1.3	1.3	22.9	22.8	I	I	19.4	18.6	10.6	10.7	11	11				
5094	43			SW	SW	1.3	1.3	16.7	16.6	I	I	17.7	17.2	9.6	10.3						
5094	53			SW	SW	1.3	1.3	9.5	9.5	S	S	13.8	13.6	8.4	8.1						
5094	63			SB	SB	1.3	1.3	18.6	18.6	I	I	19.5	19	9.4	10.2						
5094	64			SB	SB	1.3	1.3	14	14.2	X		12.7	14.5			4	4		1		
5097	3			AW	Aw	1.3	1.3	30.2	30.2	C	C	27.3	26.8	18.2	16.4	18	18				
5097	13			AW	Aw	1.3	1.3	19.5	19.5	I	I	21.5	22.4	15	16.2	1	1	12	12		
5097	23			SW	Sw	1.3	1.3	22.2	22.2	I	I	17.3	16.6	5.8	4.7						
5097	33			AW	Aw	1.3	1.3	25.9	25.9	C	C	24.9	22.9	17.6	17.5	15	15	11	11	12	12

PLOT NUMBER	TREE NUMBER	SECTION		TREE SPECIES		BREAST HEIGHT (m)		DBH (cm)		CROWN CLASS		TREE HEIGHT (m)		HEIGHT TO CROWN		CC1		CC2		CC3	
		Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit
5097	43			SW	Sw	1.3	1.3	18	18.1	S	I	15.2	14.9	3.5	3.5	19	19				
5105	4			PL	Pl	1.3	1.3	27.9	27.8	C	C	21.4	21.6	13.2	12.8						
5105	14			PL	Pl	1.3	1.3	30.9	31	C	C	22.5	22.5	15.7	14.2	11	11				
5105	24			SW	Sw	1.3	1.3	36.8	36.7	C	C	25.6	25.7	14.9	12.7	1	1		12		
5105	34			PL	Pl	1.3	1.3	17.8	17.8	I	I	18.1	18.2	9.6	9.6	11	11	18	18		
5105	36			SW	Sw	1.3	1.3	36.6	36.5	D	D	27.4	27.7	6	6.7						
5107	6			FB	Fb	1.3	1.3	17.4	17.5	C	I	17.3	17.1	3.6	3.5						
5107	16			PB	Pb	1.3	1.3	12.1	12.2	I	I	13.9	14.6	8.2	9.2	11	11				
5107	26			FB	Fb	1.3	1.3	17.1	17.1	C	I	17.8	17.5	3.7	4						
5107	36			PB	Pb	1.3	1.3	14.5	14.4	I	I	16.3	16.2	8.9	8.9	11	11		1		
5107	46			FB	Fb	1.3	1.3	9.7	9.8	S	S	9.9	9.6	4	2	11	11				
5107	56			PB	Pb	1.3	1.3	20.1	20.1	C	C	19.4	19.3	13	13.1						
5107	65			PB	Pb	1.3	1.3	10.2	10.5	S	S	12	11.1	10.7	9.6	11	11				
5107	66			FB	Fb	1.3	1.3	10.8	10.9	S	S	10.9	13.6	3.2	3.2						
5108	1			AW	AW	1.3	1.3	22.7	22.7	C	C	20.4	20.4	13.4	12.3	11	11	12	12		
5108	11			SW	SW	1.3	1.3	9.3	9.3	X		9.5				5	5				
5108	12			SW	SW	1.3	1.3	12.1	12.1	S	S	12.5	12.1	8.6	7.8	11	11	12	12		
5108	21			SW	SW	1.3	1.3	24.9	24.8	C	C	22.2	21.8	9.8	9.7						
5108	31			AW	AW	1.3	1.3	30.9	30.9	C	C	22.8	22.6	15.8	14.1	11	11	12	12		
5108	41			SB	SB	1.3	1.3	19.3	19.2	I	I	17.6	17	7.5	7.4						
5108	51			SB	SB	1.3	1.3	12.2	12.2	S	S	13.3	13	5.9	5.8						
5108	52			SB	SB	1.3	1.3	18.8	18.6	I	I	16.5	16.1	4.8	4.5						
5109	2			SW	SW	1.3	1.3	39.5	39.4	D	D	26.2	26.4	11.9	9.8	19	19	1	1		
5109	12			SW	SW	1.3	1.3	11.6	11.7	S	S	11.1	10.7	4.2	5						
5109	23			SW	SW	1.3	1.3	23.5	23.5	S	S	15.4	15.4	10.2	6.9	11	11				
5109	29			SW	SW	1.3	1.3	24.5	25.3	C	C	20.8	20.2	9.6	7.9						
5110	1			BW	BW	1.3	1.3	11	11	I	I	10.1	10	1.8	1.4	11	11				
5110	3			SW	SW	1.3	1.3	13.6	13.6	I	I	9.4	9.7	1.5	0.2						
5110	13			PB	PB	1.3	1.3	10	10	C	C	12.5	12.4	4.5	3.9						
5110	23			FB	FB	1.3	1.3	22.7	22.5	D	D	14.3	14.4	5.5	1.4	12	12				
5110	31			PB	PB	1.3	1.3	23.5	23.5	D	D	14.3	14.4	4.1	4.4						
5112	5			SW	SW	1.3	1.3	16.4	16.4	C	C	10.2	9.9	1.6	1						
5112	15			SW	SW	1.3	1.3	15.8	15.8	I	I	8.2	8	1.7	1	11		2	2		
5112	16			SW	SW	1.3	1.3	14.6	14.6	C		10.2	10	1.3	1.3	12					
5113	1			SW	SW	1.3	1.3	29.2	29.2	C	C	25.3	23.5	6.7	5.1	11	11				
5113	11			SW	SW	1.3	1.3	40.4	40.3	D	D	28.3	26.1	6.6	7.4						
5113	21			SW	SW	1.3	1.3	26	25.9	C	C	25.1	25	15.3	13.9						
5113	27			SW	SW	1.3	1.3	18	14	I	I	19.7	19	9.6	7.4						
5115	6			PB	PB	1.3	1.3	37.5	32.5	C	C	27.4	26.9	19.3	18.6						
5115	16			SW	SW	1.3	1.3	21.6	21.4	I	I	22.4	22	9.6	5	1	1	11	11		
5115	26			SW	SW	1.3	1.3	43.1	43.2	D	D	28.6	28.1	18.7	5						
5115	27			PB	PB	1.3	1.3	42.7	42.7	I	I	23.9	23.3	17.5	16.7	1	1	11	11		
5119	4			SW	SW	1.3	1.3	23.9	24	I	I	19.2	18.6	3.5	3.5		19				
5119	14			SW	SW	1.3	1.3	21.5	21.6	I	I	18.7	17.9	3.9	3.5						
5119	15			SW	SW	1.3	1.3	24.3	24.2	I	I	20.3	20.8	8.6	8.2						
5120	5			SW	Sw	1.3	1.3	53.5	53.4	I	I	16.1	15.5	3.5	4	22	22		14		
5120	6			SW	Sw	1.3	1.3	43.3	43.3	C	C	24.1	23.8	4.4	4.5						
5124	2			SW	SW	1.3	1.3	24.9	24.5	D	D	23.4	22.6	8.1	9.1						
5124	12			PL	PL	1.3	1.3	18.2	17.2	I	I	17.7	17.1	12.8	12.8	19	19	11	11		
5124	22			AW	AW	1.3	1.3	15.6	14.5	I	I	18.2	18.5	14.1	14.1	11	11	12	12		
5124	32			AW	AW	1.3	1.3	23.1	23	C	C	22.5	22.1	16.6	14.5	18	18				
5124	43			SB	SB	1.3	1.3	23.5	23	C	C	22.3	21.5	8.2	4						
5124	52			AW	AW	1.3	1.3	22.6	22.2	C	C	18.7	19	14.5	12.2	18	18				
5124	63			AW	AW	1.3	1.3	18.6	18.4	C	C	17.3	17.3	14.3	11.4						
5124	72			SW	SW	1.3	1.3	26.5	25.9	C	C	17.9	17.4	5.1	4		1				
5124	83			SW	SW	1.3	1.3	24.5	23.8	I	I	16.9	16.3	3.5	3.5						
5124	85			AW	AW	1.3	1.3	17.2	17	C	C	20	19.8	15	13.6		11				
5126	2			SB	SB	1.3	1.3	9.2	9.3	S	S	8.4	8.4	3.1	2.4						
5126	12			SB	SB	1.3	1.3	22	21.9	S	S	10.3	10	1.3	1.3						
5126	22			AW	AW	1.3	1.3	15.1	15.3	X	X	16.8				4	4				
5126	24			SB	SB	1.3	1.3	11.3	11.3	S	S	10.3	10.2	4.8	5.3						
5126	32			SB	SB	1.3	1.3	11	11	S	S	8.9	8.7	2.4	2.5						
5126	42			SB	SB	1.3	1.3	10.7	10.7	S	S	9.8	9.5	4.4	4.1						
5126	52			AW	AW	1.3	1.3	15.3	13.7	X	X	17				4	4				
5126	53			SB	SB	1.3	1.3	14.6	14.6	I	I	12.4	12.4	8.8	4.5						
5126	58			AW	AW	1.3	1.3	18.3	18.3	X	X	18.8	12.6			4	4				
5126	59			AW	AW	1.3	1.3	17.1	17.1	X	X	18.1	15.8			4	4				
5129	4			BW	BW	1.3	1.3	13.6	13.5	S	S	8.2	8.4	6.9	6.9	1	1	12	12		
5129	14			SW	SW	1.3	1.3	13.1	13.1	I	I	14.9	14.7	10.4	10.9	11	11				
5129	24			BW	BW	1.3	1.3	12.4	12.3	I	I	14.8	14.5	10.6	9.7	11	11				
5129	34			BW	BW	1.3	1.3	16.3	16.4	C	C	15.2	16.5	6.5	6.6	1	1				
5129	35			SW	SW	1.3	1.3	13.4	13.3	I	I	13.3	13.9	3.8	3.6						
5129	40			BW	BW	1.3	1.3	11.3	11.3	I	I	13.6	13.6	9.1	9.1	11	11				
5131	3			SB	SB	1.3	1.3	17.1	17.1	C	C	11.9	10.5	2.3	2.3	11	11				
5131	13			SB	SB	1.3	1.3	16.3	16.1	X	X	14.1				4	4				
5131	14			SB	SB	1.3	1.3	10.9	10.7	I	I	9.9	9.7	6.6	6.6	11	11				
5131	23			SB	SB	1.3	1.3	14.2	13.8	C	C	14.4	13.7	10.8	10.3						

PLOT NUMBER	TREE NUMBER	SECTION		TREE SPECIES		BREAST HEIGHT (m)		DBH (cm)		CROWN CLASS		TREE HEIGHT (m)		HEIGHT TO CROWN		CC1		CC2		CC3	
		Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit	Field	Audit
5131	33			SB	SB	1.3	1.3	14.2	14	C	C	13.1	12.6	9.2	8.8	11	11	1	1		
5131	43			SB	SB	1.3	1.3	14.7	14.5	C	C	11.9	11.3	8	4						
5131	53			SB	SB	1.3	1.3	18.2	17.9	C	C	11.6	11.2	6.6	7						
5131	63			SB	SB	1.3	1.3	9.7	9.6	X	X	9.5				5	5				
5131	64			SB	SB	1.3	1.3	12.2	12	C	C	11	10.6	4.6	5.5						
5131	65			SB	SB	1.3	1.3	15.1	14.7	C	C	13.2	13	1.4	1.4						
5136	5			AW	Aw	1.3	1.3	21.2	21.2	C	C	22.1	21.2	13.7	15		11				
5136	15			AW	Aw	1.3	1.3	14.1	14.2	S	S	14.7	14.9	10.8	10.4						
5136	27			AW	Aw	1.3	1.3	21.1	21.4	C	C	22.1	21.7	18	16						
5136	35			AW	Aw	1.3	1.3	17.5	17.7	C	C	21.4	20.6	14.5	14.3						
5136	45			SW	Sw	1.3	1.3	17.2	17.4	S	S	14.4	13.8	1.2	1.5						
5136	47			AW	Aw	1.3	1.3	18.6	18.9	I	I	19.1	18.7	14.2	12.9	11	11				
5137	6			PL	Pl	1.3	1.3	19.3	19.5	C	C	21.1	21	15.4	16.3						
5137	16			SB	Sb	1.3	1.3	27.8	23.6	C	C	23	22.5	9.7	10.7						
5137	26			SB	Sb	1.3	1.3	21.9	22	C	C	21.5	21.4	8.8	7.3						
5137	36			SB	Sb	1.3	1.3	13.8	15.9	I	I	14.8	14.3	2	2						
5137	46			SB	Sb	1.3	1.3	22.4	22.4	C	C	18.1	17.6	2.2	2						
5137	56			SB	Sb	1.3	1.3	14.3	14.3	I	I	14.3	14	3.7	4.7	11	11				
5137	67			PL	Pl	1.3	1.3	31.1	31.5	C	C	21.5	22.2	13.5	11.5	11	11				
5137	76			PL	Pl	1.3	1.3	29	28.8	C	C	19.7	19.6	14.7	13.6	11	11	12	12		
5137	81			SB	Sb	1.3	1.3	11.5	11.6	I	I	11.9	11.2	2.5	2.5						
5141	15			PL	PL	1.3	1.3	30	29.9	I	I	22	21.1	5.7	5.4		11				
5143	5			PL	Pl	1.3	1.3	21.1	21.3	I	I	19.4	19.9	13.6	13.9	19	19	18	18		
5143	12			PL	Pl	1.3	1.3	26.5	26.7	C	C	22.5	23	10.9	11.4	19	19				
5143	13			PL	Pl	1.3	1.3	15.3	15.5	I	I	14.9	15	11.6	10.9	18	18				
5145	1			SB	SB	1.3	1.3	9.5	9.1	I	I	11	10.6	5.2	4.9						
5145	11			SB	SB	1.3	1.3	13.5	13.4	C	D	12.9	12.6	5.1	4.7						
5145	21			SB	SB	1.3	1.3	11	11.1	X	S	7.4	6.8	3.3	3.5	7		11	11	1	1
5145	31			SB	SB	1.3	1.3	10.5	10.6	I	I	9.9	9.7	4.9	3.6	11	11				
5146	1			SB	Sb	1.3	1.3	9.3	9.4	C	C	6.9	6.8	2	2	11	11				
5146	6			SB	Sb	1.3	1.3	9.3	9.3	C	C	9.1	9.2	8.4	8.5						
5146	9			SB	Sb	1.3		14.9		X		13.2		8.8		4	4				
5146	10			SB	Sb	1.3	1.3	11.2	11.1	X		10.7		7.2		4	4				
5162	7			SB	Sb	1.3	1.3	13	13	I	I	9.4	9.5	2.4	3.1						
5162	17			SB	Sb	1.3	1.3	10.9	11	I	I	10.9	10.7	4.9	5						
5162	27			SW	Sw	1.3	1.3	12.8	12.9	I	I	12.7	12.7	4.3	4.4						
5162	39			SB	Sb	1.3	1.3	11.1	11.6	I	I	10.3	10.2	5.4	4.9						
5162	41			SB	Sb	1.3	1.3	12.6	12.5	I	I	11.7	12	7	7.5						
5163	1			PB	Pb	1.3	1.3	44.2	44.3	C	C	21.2	23.7	10.9	10.2	1	1				
5163	11			PB	Pb	1.3	1.3	21.7	21.8	C	C	18.5	18.9	9.3	9.6	18	18	12	12		
5163	21			PB	Pb	1.3	1.3	29.7	29.9	C	C	20.8	21.3	13.3	10.3	19	19				
5165	6			SW	Sw	1.3	1.3	19.4	19.6	I	I	14	14.1	5.7	6.1	1	1	11	11		
5165	16			SW	Sw	1.3	1.3	25.7	25.5	I	I	17.2	17.5	8.4	7.5	1	1	11	11	12	12
5165	26			SW	Sw	1.3	1.3	28	28	C	C	21	21.8	16.7	15						
5165	36			SW	Sw	1.3	1.3	27.4	27.9	C	C	20	19.4	7.7	7.4		11				
5165	37			SW	Sw	1.3	1.3	14	14.2	S	S	13.3	13.1	5.2	4.6						
5166	8			SW	Sw	1.3	1.3	30.3	30.7	C	C	22.4	23	11.8	9						
5166	18			AW	Aw	1.3	1.3	21.1	21.3	I	I	17.6	17.3	13.8	13.7						
5166	28			SB	Sb	1.3	1.3	19.8	19.8	I	I	14.5	14.6	4.7	5						
5166	38			SB	Sb	1.3	1.3	14.3	14.4	S	S	12.3	12.5	7.8	8.6						
5166	48			SB	Sb	1.3	1.3	14.2	14.3	S	S	14.1	14.3	9.2	9.5						
5166	58			SB	Sb	1.3	1.3	12.2	12.1	X	X	11.4				5	5				
5166	68			AW	Aw	1.3	1.3	16.8	16.7	X	X	17.9				4	4				
5166	69			AW	Aw	1.3	1.3	31.2	31.1	C	C	23.6	23.9	16.6	13.6						
5168	1			SW	Sw	1.3	1.3	38.4	38.5	D	D	26.5	26.8	8.1	7.6						
5168	10			SW	Sw	1.3	1.3	47.6	47.9	D	D	25.8	26.3	5	5						
5168	20			SW	Sw	1.3	1.3	20.7	20.9	C	C	19.8	20.4	4.6	4.5						
5168	30			SW	Sw	1.3	1.3	39.1	39.1	C	C	26	26.8	7.7	7.5						
5168	32			SW	Sw	1.3	1.3	17.3	17.4	C	C	19.9	20.4	10.3	10						
5173	9			FB	Fb	1.3	1.3	10	10	S	S	11.9	10.9	6.9	6.5						
5173	19			FB	Fb	1.3	1.3	17.2	17.2	S	S	15.2	14.1	4.1	4.5						
5173	29			SW	Sw	1.3	1.3	24.6	24.7	C	C	19.2	18.4	6.3	7						
5173	39			FB	Fb	1.3	1.3	26	26	X	S	11.7	11.4	7.8	8.3	9		8	8		
5173	40			SW	Sw	1.3	1.3	17.4	17.5	X	X	16.2				5	5				



DAISHOWA-MARUBENI INTERNATIONAL LTD.

Peace River Pulp Division

Landscape Assessment

Detailed Forest Management Plan

2009-2018

January 2012

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1 Background

In setting management objectives, it is critical to understand the key elements that describe a forest, and historical levels of these elements in the forest. It is also important to gain an understanding of ecological processes (e.g. succession dynamics, disturbance), history and local context describing the mosaic of human activity on the landscape, in order to improve the ability to predict change in the future and to select appropriate actions in the balance of multiple values. To gain this understanding and to set a baseline for the 1999 plan, the company commissioned Dr. Brad Stelfox (currently of ALCES Group). The result was a comprehensive regional synopsis[1] of the physical, biological and human land-use features of northwest Alberta that was presented as a companion document to the 1999 DMI plan. That document provided not only a landscape assessment, but also served as a first approximation of spatial and temporal patterns that define this region, emphasizing appropriate spatial and temporal scales for northwest Alberta, and considering land-uses in terms of their cumulative impact.

The assessment also provided a background for the establishment of initial objectives, strategies and ecologically-based practices in the 1999 forest management plan. Included is an analysis of forest structure, function and human factors within the northwest boreal forest, little of which is different in principle today. As such it can still be used as a backdrop to evaluate and interpret the management strategy proposed in this current management plan. The report also clearly identified knowledge gaps in 1999 that have been used since then to guide DMI participation in research programs to the present time. In the preparation of new DFMPs for the Westside FMA and Eastside FMA, DMI updated the previous assessment to meet current Alberta Forest Management Planning Standards and conditions.

[1] A Physical, Biological and Land-Use Synopsis of the Boreal Forest's Natural Regions of Northwest Alberta. Stelfox J.B., Wynes B. et al (DMI) September 1999. 918pp.

2 Administrative Boundaries

2.1 Forest Management Agreement and Defined Forest Area

A Forest Management Agreement (FMA) is defined as an area-based agreement between the Government of Alberta and the FMA holder that gives the FMA holder the right to establish, harvest and utilize timber from the area covered by the FMA, in return for which the FMA holder commits to specific forest management responsibilities.

DMI's Forest Management Agreement (FMA8900027) expired in 2009. Negotiations for the renewal of the FMA have resulted in the creation of two separate FMAs as follows:

- **FMA090045 or Westside FMA** (West of the Peace River) consists of former Forest Management Units (FMUs) P10, P13 (P1S, P2, P11), P17 (P1N) which were amalgamated effective May 2010 to form one P19 FMU. Two separate Volume Supply Areas remain defined as per Appendix "C" of this FMA.; and
- **FMA090044 or Eastside FMA** (East of the Peace River) consists of FMUs P3, P4, P5, S15, and F1.

Detailed Forest Management Plans for these two FMAs guide the company's activities within the two FMAs that together constitute DMI's Defined Forest Area (DFA). Figure 2.1 shows the DFA in a provincial context while Figure 2.2 shows the FMAs and FMUs that make up the DFA.

The DFA extends from the British Columbia border in the west to east of Red Earth and from La Crete south to Nampa. The area is situated in the boreal mixed wood forest in north-western Alberta. The DFA lies between latitudes 56 – 58^{o} N and longitudes 114 - 120^{o} W and covers a total area of approximately 2.7 million hectares or 27,000 km^{2}.

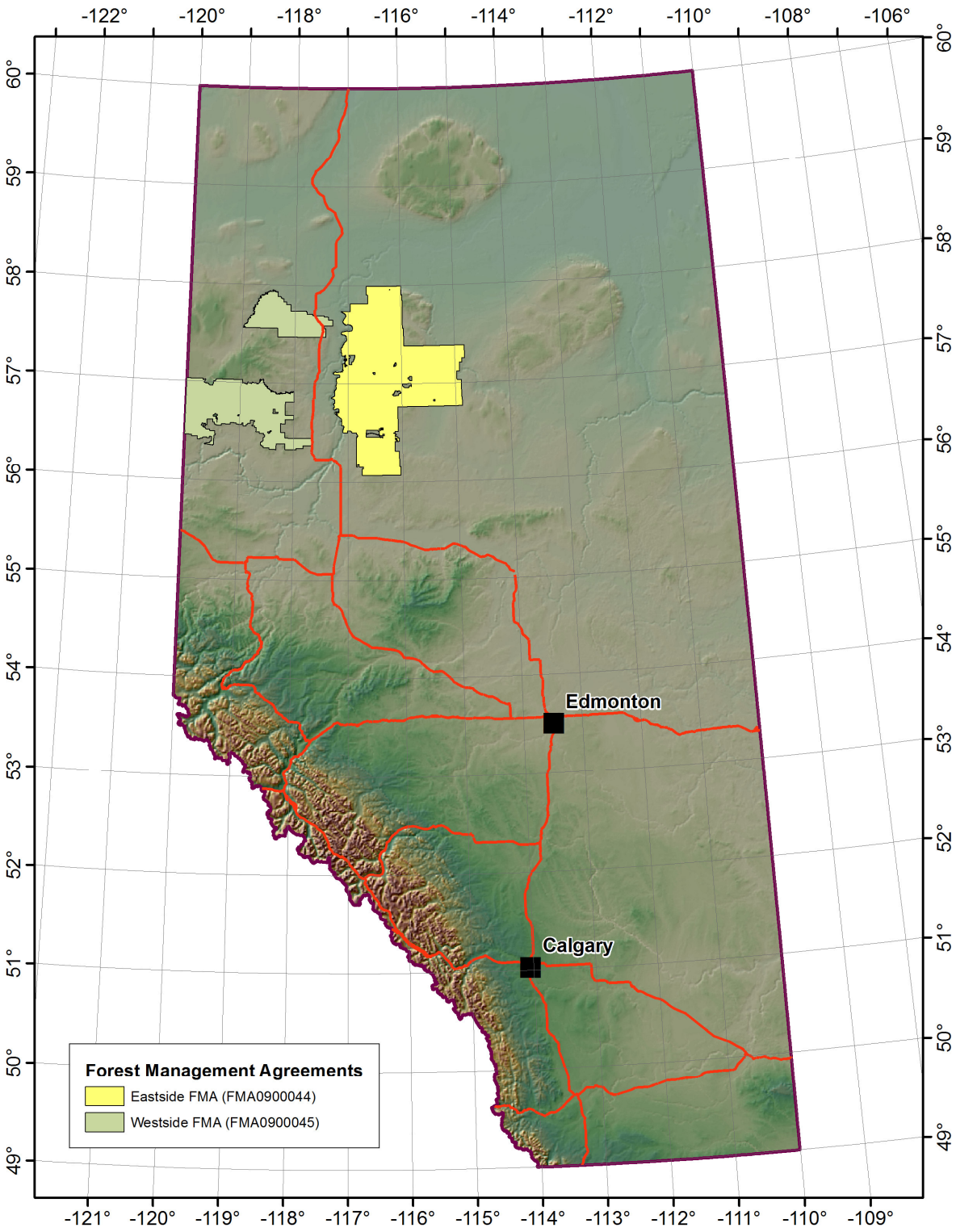


Figure 2.1 : Location of DMI's Defined Forest Area within Alberta.

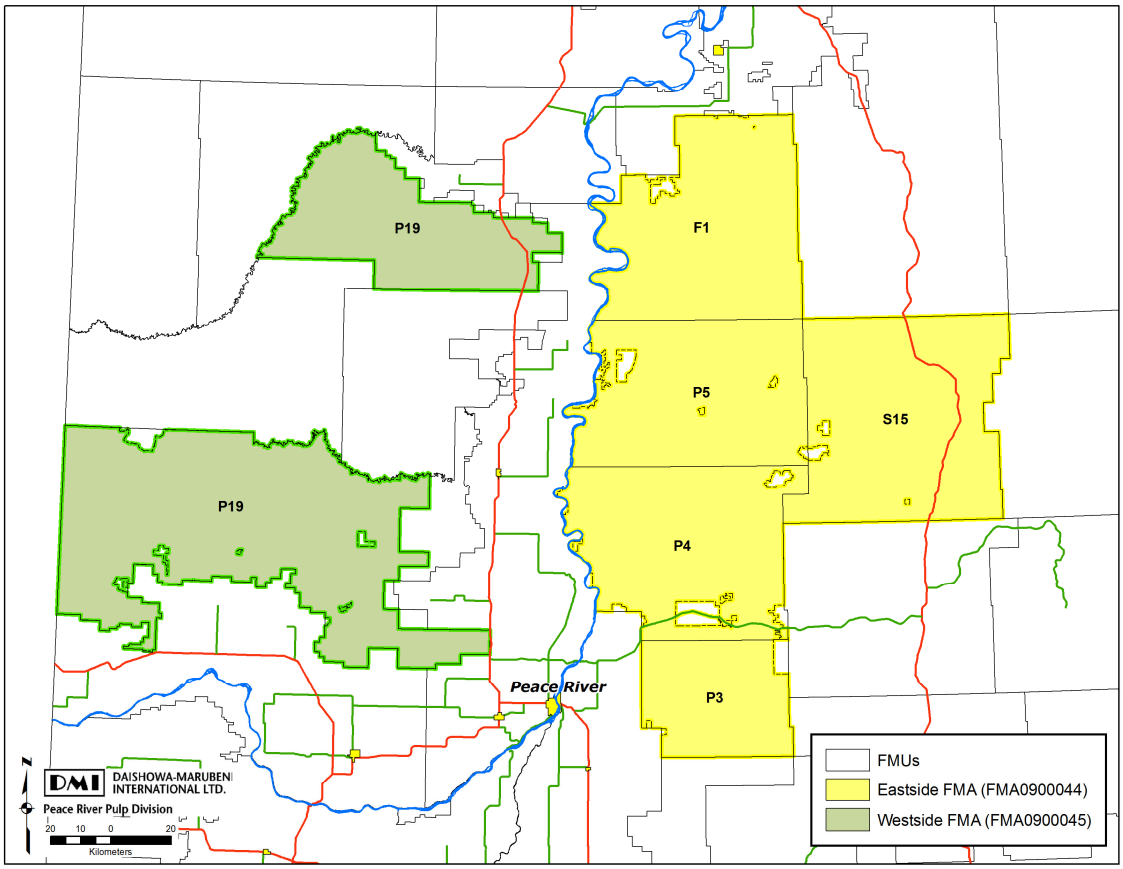


Figure 2.2 : DMI's FMAs and corresponding Forest Management Units.

2.2 Compartments and Operating Areas

Forest Management Units (FMUs), Compartments and Operating Areas are all geographic sub-units of the FMAs that are used for administrative and reporting purposes. This forest management plan retains the use of FMUs because wood-supplies for embedded quota-holders have traditionally included FMU-specific quota's on the coniferous AAC. DMI has further compartmentalized the FMA by the following hierarchy:

- Compartments have boundaries generally following Alberta Natural Subregions, and
- Operating Areas use logical boundaries driven by business rules (e.g. dominant accessibility barriers based on watercourses or terrain)

Both the Compartments and Operating Areas have been named using local geographic-feature references. Figure 2.3 shows the resulting geo-administrative land unit hierarchy for the DMI FMA's. Consequently, the company's FMA's have the following Compartments each of which contain one or more Operating Areas:

- Westside FMA: there are twelve (12) compartments including Chinchaga, Keg River, Kemp River, Boundary North, Boundary, Clear Hills, Clear River, Deer Hill, Notikewin, Running Lake, Stoney Lakes and Sulphur Lake.

- Eastside FMA: there are five (5) compartments including Cadotte Lake, Central, East Peace, La Crete, and Red Earth.

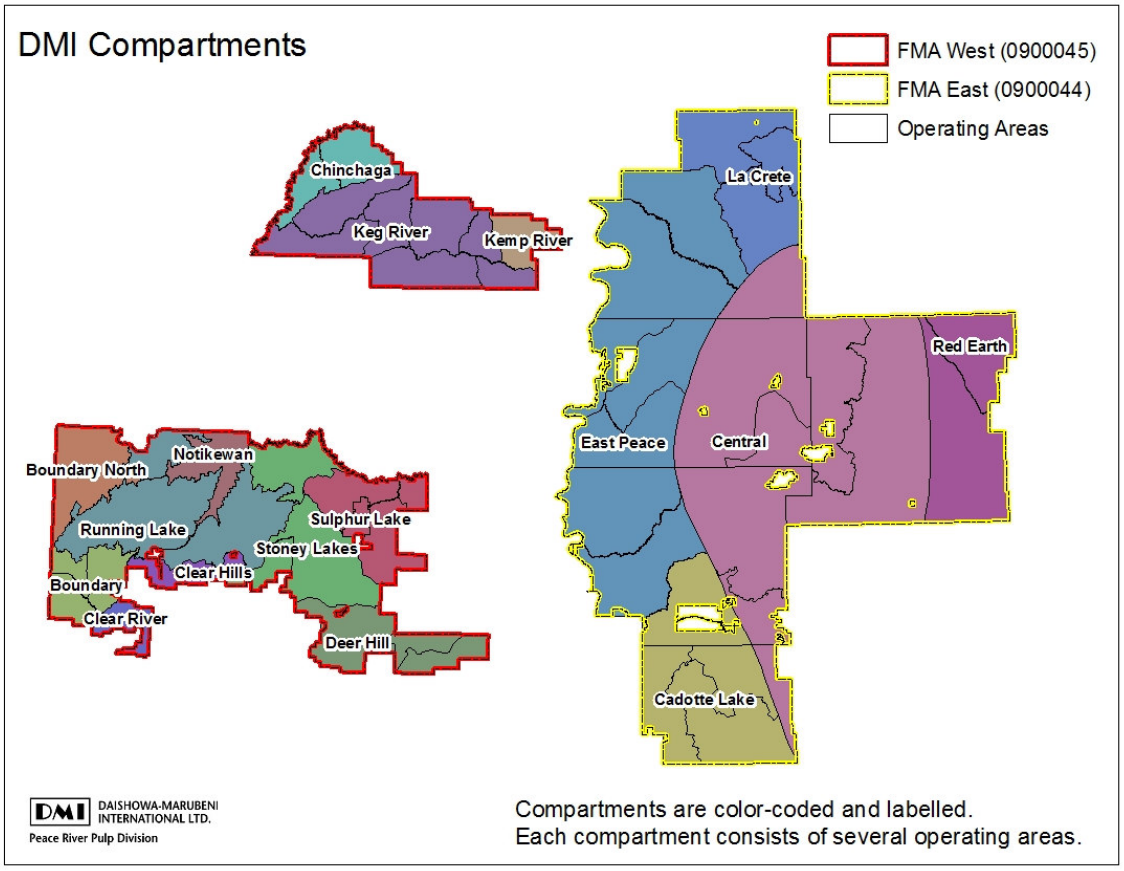


Figure 2.3 : DMI Compartments and Operating Areas

2.3 Natural Subregions

Natural regions are the largest mapped ecological units in Alberta's classification system. This stratification of Alberta is based on regions of similar landform, climate, and plant community structure. The ecological regions were further subdivided into natural subregions based on vegetation, climate, elevation and other physical differences within the region. The existence of better data, climate models and improved ecological knowledge led to the need to revise the 1994 classification, published in 2006[2]. The 2006 classification is considered to be the best current approximation of province-wide biophysical patterns given the climatic and biophysical information available to date. DMI's FMAs lies within four subregions of the Boreal Forest Natural Region. These are the Central Mixedwood, Dry Mixedwood, Lower Boreal Highlands and Upper Boreal Highlands subregions. Table 2.1 below summarizes the area by natural subregion for each FMU and FMA, drawn from gross land area calculations.

[2] Natural Regions Committee 2006. Natural Regions and Subregions of Alberta. Compiled by D.J. Downing and W.W. Pettapiece. Government of Alberta. Pub. No. T/852.

Table 2.1 : Area by natural subregion

FMU	Central Mixedwood		Dry Mixedwood		Lower Boreal Highlands		Upper Boreal Highlands		Total	
	Ha	%	Ha	%	Ha	%	Ha	%	Ha	%
FMA West										
P19n	57,078	9.4%	21,922	2.3%	206,305	21.3%			285,305	10.5%
P19s			20,700	2.1%	459,319	47.4%	204,070	21.1%	684,089	25.1%
Total	**57,078**	**9.4%**	**42,621**	**4.4%**	**665,624**	**68.7%**	**204,070**	**21.1%**	**969,394**	**35.6%**
FMA East										
F1	3,545	0.2%	224,361	12.8%	127,831	7.3%	28,812	1.6%	384,549	14.1%
P5			230,760	13.1%	115,489	6.6%	9,530	0.5%	355,779	13.0%
P4	65,911	3.8%	176,740	10.1%	144,175	8.2%	1,993	0.1%	388,818	14.3%
P3	180,726	10.3%	4,150	0.2%					184,876	6.8%
S15	303,092	17.2%			68,731	3.9%	71,508	4.1%	443,331	16.3%
Total	**553,273**	**31.5%**	**636,010**	**36.2%**	**456,225**	**26.0%**	**111,843**	**6.4%**	**1,757,352**	**64.4%**
Grand Total	**610,351**	**22.4%**	**678,632**	**24.9%**	**1,121,850**	**41.1%**	**315,913**	**11.6%**	**2,726,746**	**100.0%**

A brief description and key features of each of the four natural subregions found on DMI's FMAs area is provided in the following sections (Figure 2.4). The information is taken from the Natural Regions and Subregions of Alberta (2006).

Dry Mixedwood

The Dry Mixedwood subregion makes up 25% of the area within the DFA and it is characterised by undulating plains, aspen-dominated forests and fens and is the warmest of the boreal natural subregions. Key features include:

- Warmer summers and milder winters than most other subregions in the Boreal Natural Region. Mean annual temperature is 1.1°C and mean annual precipitation is 461mm.
- Aspen stands with scattered white spruce interspersed with fens; cultivated areas on suitable soils throughout.
- Two climatically distinct areas within this natural subregion (Peace River and southern).
- Gray and Dark Gray Luvisols on uplands; Gleysols and Organic soils in wetlands.

Central Mixedwood

The Central Mixedwood subregion makes up 22% of the DFA and it is characterised by vast expanses of upland forests and wetlands on level to gently undulating plains with short, warm summers and long, cold winters. It is the largest natural subregion in Alberta. Key features include:

- A mosaic of aspen, mixedwood and white spruce forests on uplands, with extensive areas of mainly treed fens in central areas and jack pine stands on coarser materials to the east.
- On average, slightly cooler and moister than the Dry Mixedwood subregion, but its extent results in north-to-south variability. Mean annual temperature is 0.2°C and mean annual precipitation is 478mm.

- Gray Luvisolic soils on medium to fine textured upland sites, with Brunisols on sands and Organic soils in poorly drained lowlands.

Lower Boreal Highlands

This is the largest subregion represented in DMI's FMAs with 41% of the DFA, 26% of the Eastside FMA and 69% of the west FMA. Diverse mixedwood forests on moist lower slopes of northern hill systems and extensive wetlands at slope bases and on adjacent lowlands are typical of this subregion. Key features include:

- Diverse young forests of aspen, balsam poplar, black and white spruce, white birch and lodgepole pine–jack pine hybrids on slopes with treed, shrubby or graminoid fens in depressions, seepage zones or level areas.
- Slightly colder winters and warmer summers than the higher-elevation Upper Boreal Highlands Natural Subregion. Moister and cooler than the adjacent Central Mixedwood and Dry Mixedwood Natural Subregions. Mean annual temperature is -1.0^{o}C and mean annual precipitation is 495mm.
- Gray Luvisols (often gleyed); wetlands are Organic soils and Gleysols.

Upper Boreal Highlands

12% of the DFA and 21% of the Westside FMA fall within this subregion. It is characterised by coniferous forests on the upper slopes and undulating plateaus of northern hill systems, with short, cool and showery summers and cold winters. Key features include:

- Predominantly coniferous forests (lodgepole pine–jack pine hybrids, white and black spruce) with locally extensive wetlands in low-lying portions of the plateaus.
- Moister with cooler summers than the adjacent Lower Boreal Highlands Natural Subregion. Mean annual temperature is -1.5^{o}C and mean annual precipitation is 535mm.
- Orthic and Brunisolic Gray Luvisols (often gleyed); wetlands are Organic soils and Gleysols.

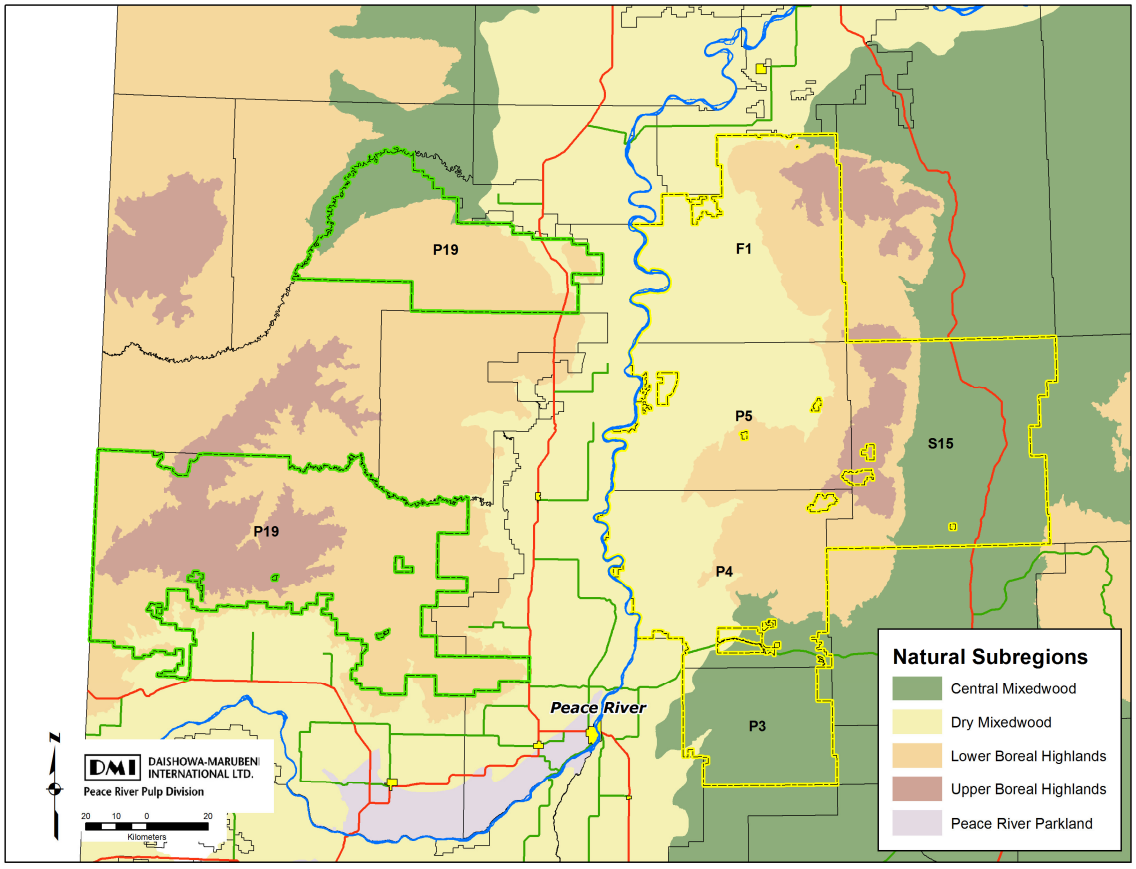


Figure 2.4 : Natural subregions in relation to DMI's FMAs.

2.4 Municipal Districts and Counties

Most of the Westside FMA falls within the Clear Hills County but an eastern and northern portion of that FMA falls in the County of Northern Lights. The Eastside FMA falls largely within Northern Sunrise County but extends into the Mackenzie County to the north and the MD of Opportunity 17 to the east. DMI's traditional non-FMA timber supplies have included occasional private-land timber purchases within and through a variety of other regional municipalities: Birch Hills County, MD of Greenview 16, MD of Smoky River 130, MD of Big Lakes, MD of Fairview 136, MD of Peace 135, MD of Spirit River 133, Saddle Hills County. Figure 2.5 illustrates the region's municipal boundaries.

Municipalities typically interact with DMI on FMA business matters involving forest management strategy development (Public Advisory forum, soci-economic-environmental balance) and operational logistics (e.g. municipal road use, FHP information-share, privateland timber, MD road development timber salvage).

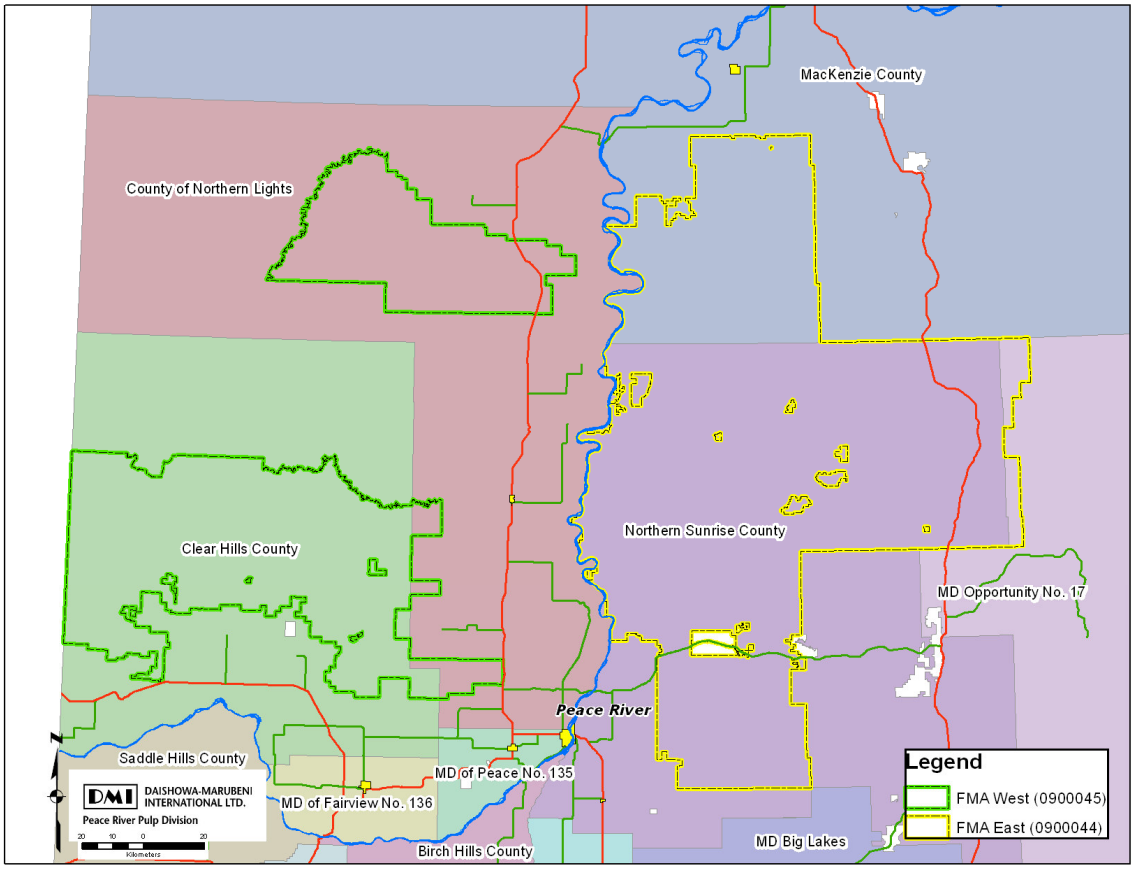


Figure 2.5 : Municipal Districts and Counties

2.5 Federal Government Lands

Federal government jurisdiction in northwest Alberta consists of one National Park (Wood Buffalo) situated 100 km northeast of the DMI FMAs, a number of designated Indian Reserves (discussed in a separate section), and shared jurisdiction on waters subject to Navigable Waters legislation. While the Province largely retains authority for biodiversity matters on provincial lands, shared jurisdiction areas include Migratory Birds associated geographic features (terrestrial or aquatic nest sites), habitat of listed at-risk species (S.A.R.A.) on National Parks and Indian Reserves, as well as any local water features containing fisheries resources.

2.6 First Nations Reserves and Metis Settlements

The *Biophysical* document contains a chapter[3] detailing the recorded history and demography of Aboriginal peoples in the region to 1995. A comparative indication of regional Aboriginal population change since the time of that earlier document is included

[3] Humans: Their Demographics, Employment, & Infrastructure. Leonard D. et al (Chapter 6. 92pp) -A Physical, Biological and Land-Use Synopsis of the Boreal Forest's Natural Regions of Northwest Alberta. Stelfox J.B., Wynes B. et al DMI September 1999. 918pp.

in Table 2.2. While population growth is evident, there is some disparity between interpretations provided by Alberta and Canada sources.

Table 2.2 : NW Alberta Aboriginal Populations

Community	1994 * Population	2006 ** Population	2008 *** Population	
Metis Settlements				
Gift Lake	716	820	999	
Paddle Prairie	652	216	1089	
First Nations				
Beaver (Boyer River)	317	338	408	
Dene Tha	2161	1640	1904	
Duncan's	101	102	132	
Horse Lake	300	335	408	
Little Red River Cree	2013	2778	3431	
Loon River Cree	282	425	390	
Lubicon Lake	130	*446*	35	
Peerless & Trout Lake (Bigstone Cree)	700	725	*723*	2008 pop from Indian & North Affairs Can.
Tall Cree	365	324	506	
Whitefish Lake	619	*2190*	1131	
Woodland Cree	539	556	700	
	8,895	**10,895**	**11,856**	

* DMI 1999 Biophysical document Table 8 (Source: Statistics Canada)

** Source: *Indian & Northern Affairs Canada (Aboriginal Canada Portal, First Nations Community Profiles)* and Statistics Canada (2006 Census)

*** Source: Alberta Municipal Affairs, Alberta Aboriginal Relations (recorded unofficial)

A number of officially designated Aboriginal lands exist within northwest Alberta, although no new ones overlapping either of DMI's FMAs have been established since 1999. At the present time, no Metis Settlements or First Nations Reserves exist on the Westside FMAarea, although there are some peripheral ones (north and south). Within the Eastside FMA perimeter a total of 19,999 ha are designated as Reserve area, including 14,615 ha for the Woodland Cree Nation and 5,384 ha for the Lubicon Lake Cree (Figure 2.6).

Beyond the official designated Reserves and Settlement lands, most Aboriginal communities identify areas peripheral to their communities that represent lands they have traditionally relied upon for cultural activities ("traditional use areas"). The consequential overlap of these forest use interests on DMI forest tenures includes the following Aboriginal peoples: Tall Cree First Nation, Woodland Cree First Nation, Duncan's First Nation, Horse Lake First Nation, Loon River Cree, Lubicon Lake Indian Nation, Paddle Prairie Metis. In 2007 DMI formalized a Corporate Aboriginal Relations Policy to clarify its approach to building upon and maintaining relationships with Aboriginal peoples who reside in and around its forest land tenures.

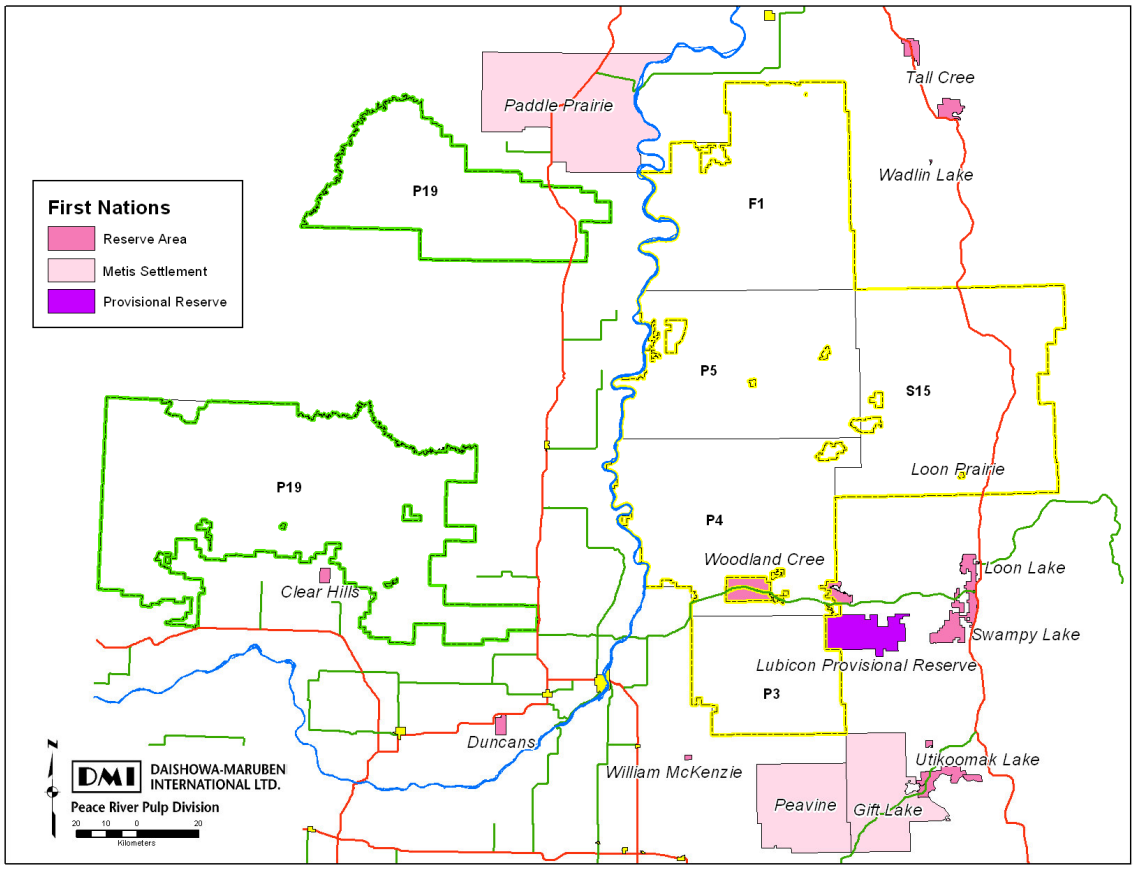


Figure 2.6 : First Nations Reserves and Metis Settlements

2.7 Protected Areas and Parks

Alberta's parks and protected areas are managed under three pieces of legislation: the Provincial Parks Act, the Wilderness Areas, Ecological Reserves, Natural Areas and Heritage Rangelands Act and the Willmore Wilderness Park Act. There are eight different classifications that provide varying degrees of protection, natural state and range of opportunity for outdoor recreation: Ecological reserves, Wilderness areas, Wildland parks, Willmore Wilderness Park, Provincial parks, Heritage rangelands, Natural areas and Provincial recreation areas[4].

Since parkland does not operate in isolation ecologically from other forested public land, it is important that such areas be identified and transboundary inter-relationships considered during forest management planning. The company has again elected to include a summary of them for the greater northwest Alberta land area, since such a regional scale is typically the minimum used in discussions of protected spaces representation. A number of provincial initiatives, including “Special Places 2000” have resulted in additions to northwest Alberta’s inventory of protected lands. Notably this

[4] From http://www.tpr.alberta.ca/parks/managing/spectrumsites.asp and DMI Biophysical document (1999, Chapter 3)

included the creation of some new large Wildland Parks: Chinchaga (overlapping FMU P19), Caribou Mountains, Hay-Zama Lakes, Dunvegan West, and Peace River.

Among the Alberta protected area classifications, three of them have no sites that exist within or adjacent to the DFA: Wilderness areas, Heritage rangelands, and Willmore Wilderness Park. On a similar conservation administration theme, a number of Recreation Reserves exist locally that are managed by non-government community groups and were included in this inventory. In addition to these, the company has also accounted for: i) some land areas formally excluded from DMI's FMAs because they represent special ecological sites (certain Appendix A / C deletions), and ii) specific Protective Notations (PNTs) within the FMA that were created to protect particular ecological or geological features and were excluded from the FMA net landbase calculations. A land area summary (hectares per category) for northwest Alberta is provided in Table 2.3, an inventory of conservation sites in Table 2.4 and their locations are shown in Figure 2.7.

Table 2.3 : Protected Land Area in Northwest Alberta

Protected Spaces Summary	**Year**			
	1998 (ha)	**1998 (%)**	**2010 (ha)**	**2010 (%)**
Northwest Alberta -Land area (ha) 1999	15,036,858		15,036,858	
Provincial Parks	9,784	0.1%	12,923	0.1%
Natural Areas	14,842	0.1%	6,048	0.0%
Ecological Reserves	1,895	0.0%	1,805	0.0%
Wildland Parks	-	0.0%	765,410	5.1%
Provincial Recreation Areas	-	0.0%	741	0.0%
National Park *	518,000	3.4%	518,000	3.4%
Other Park PNT's	-	0.0%	4,928	0.0%
Community REC Reserves (FMA)	-	0.0%	211	0.0%
DMI FMA Deletions (special sites)	36,314	0.2%	36,314	0.2%
Total Protected Space (ha)	**580,835**	**3.9%**	**1,346,380**	**9.0%**

* -portion of Wood Buffalo National Park within northwest Alberta (56–60°N, 114–120 °W).
Sources: 1999 DMI Biophysical document
2010 - Ab. Gov (http://www.tpr.alberta.ca/parks -Land Reference Manual)

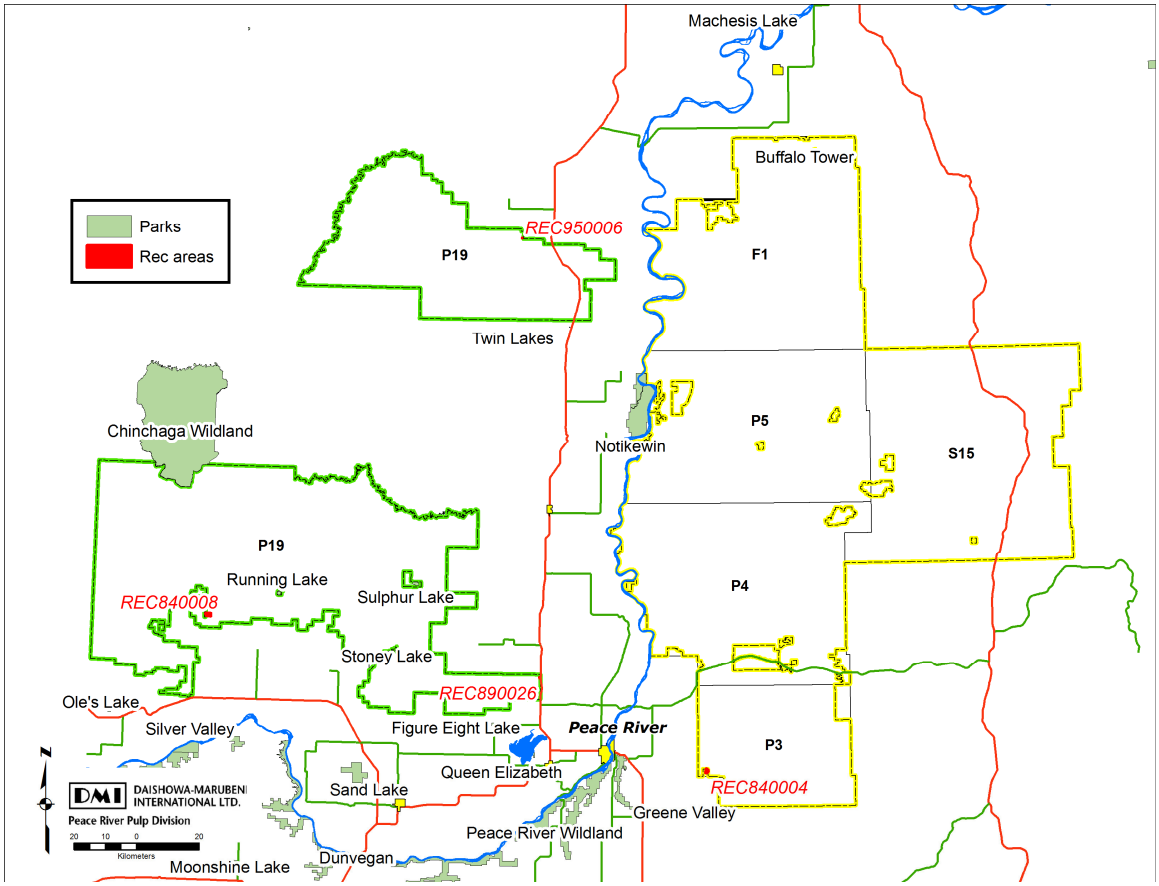


Figure 2.7 : Protected Areas and Parks

Table 2.4 : Protected Spaces Inventory –Northwest Alberta

Protected Space Type	Name	Size
Provincial Parks	Dunvegan Provincial Park	9.3
	Greene Valley Provincial Park	3,131.3
	Notikewin Provincial Park	9,696.8
	Queen Elizabeth Provincial Park	85.6
Natural Areas	Caribou River	195.0
	Child Lake Meadows	388.5
	Harper Creek	2,620.0
	Sand Lake	2,844.4
Ecological Reserves	Silver Valley	1,805.1
Wildland Parks	Caribou Mountains	591,008.4
	Chinchaga	80,270.4
	Dunvegan West	20,967.8
	Hay-Zama Lakes	48,600.1
	Peace River	24,563.2
Provincial Recreation Areas	Buffalo Tower	19.8
	Figure Eight Lake	90.1
	Fort Vermilion	5.0
	Machesis Lake	77.5
	Ole's Lake	81.1
	Peace River	5.3
	Rainbow Lake	25.4
	Running Lake	106.7
	Stoney Lake	174.0
	Sulphur Lake	151.1
	Twin Lakes	5.0
National Park *	Wood Buffalo (portion)	518,000.0
Parks PNT's (pending potential)	Hot Pot Natural Area	65.0
	Watt Mountain Natural Area	998.0
	Ponton River + Ponton River South NA	1,123.0
	Caribou River Natural Area	883.0
	Boyer Natural Area	130.0
	Burning Sulphur Natural Area	130.0
	Leddy -St. Germaine Lakes PRA PNT840638	983.4
	Highland Park Natural Area	293.0
	Dunvegan Natural Area PNT840001+2	322.8
Community REC Reserves (FMA)	REC840004 Northern Sunrise County	75.0
	REC840008 -Worsley Ski Hill	129.7
	REC890026 -Long Lake Water Ski Club	6.1
	REC950006 -Keg River	0.4
DMI FMA Deletions (special sites)	Embedded Non-FMA (West)	11,627.8
	Embedded Non-FMA (East)	21,164.7
	PNT's + Research Sites (West)	1,210.1
	PNT's + Research Sites (East)	2,311.8
TOTAL (ha)		**1,346,380**

2.8 Wildfire Management Areas

The Westside FMA falls entirely within the Peace Wildfire Management Area (WMA) with wildfire management and operations being administered from the Peace River Fire

Centre. The Eastside FMA also falls mostly into the Peace WMA but crosses into the Lesser Slave WMA which is administered from Slave Lake.

Alberta forest protection personnel typically interact with DMI on a variety of forest management matters within these WMA's: FireSmart project initiatives (e.g. assessments, strategy), insect and disease response, wildfire prevention programs, pre-suppression resources, and wildfire suppression during peak emergency periods of fire hazard within the DFA.

2.9 Regional Planning Forums

Northwest Alberta is included in two broad Alberta government initiatives for regional land use planning (Land Use Framework) and watershed planning (Water-for-Life) that will influence forest management tenures, plans and activities. This region and DMI's DFA are encompassed within two geo-spatial zones for future land use planning forums and two zones for shared governance in watershed planning.

The Land Use Framework describes a strategy to develop regional land-use plans based on seven newly defined land-use regions in Alberta.[5] This cross-departmental strategy has created new legislation and a Land-use Secretariat to oversee the development of these plans through coordination of government departments and formation of Regional Advisory Councils (RAC's). Their purpose is to assist Alberta in establishing regional land-use management objectives, thresholds, trade-offs and land-use outcomes integrating economic, environmental and social factors. The RAC's will offer advice to inform municipal and provincial decision processes (e.g. integrated land and resource management plans). Figure 2.8 illustrates the designated land use planning zones for northwest Alberta. The DFA is encompassed within two separate RAC's; Lower Peace RAC (east FMA, FMU P19 north, small easterly portions of FMU P19 south) and the Upper Peace RAC (portion of west FMA).

The Water for Life strategy defines regional Watershed Planning and Advisory Councils (WPAC's) as a mechanism of shared governance or decision making within watershed management zones.[6] Their purpose is to engage governments, industry, NGOs, and the general public in watershed assessment and planning toward the delivery of status reports on watersheds and watershed management plans for recommendations to local, provincial and federal governments. At present, there are ten WPACs established in the province with one pending for the Peace River watershed. The DFA is encompassed within two separate WPAC's; predominantly the proposed Peace WPAC, and a small portion of the Eastside FMA within the Lesser Slave Watershed Council (see Figure 2.9).[7]

[5] Alberta Land Use Framework., December 2008., 58pp.
[6] Alberta Water Council., Strengthening Partnerships: A Shared Governance Framework for Water for Life Collaborative Partnerships., September 2008, 40pp
[7] Alberta government., Water for Life: Facts and Information on Water in Alberta -2010 Revision

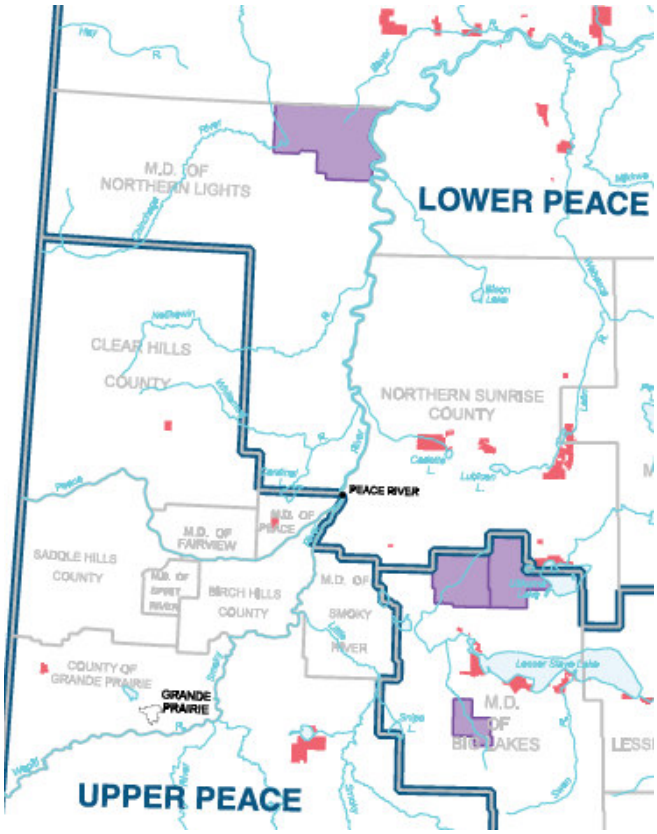


Figure 2.8 : Alberta Land Use Planning Zones –Regional Advisory Councils

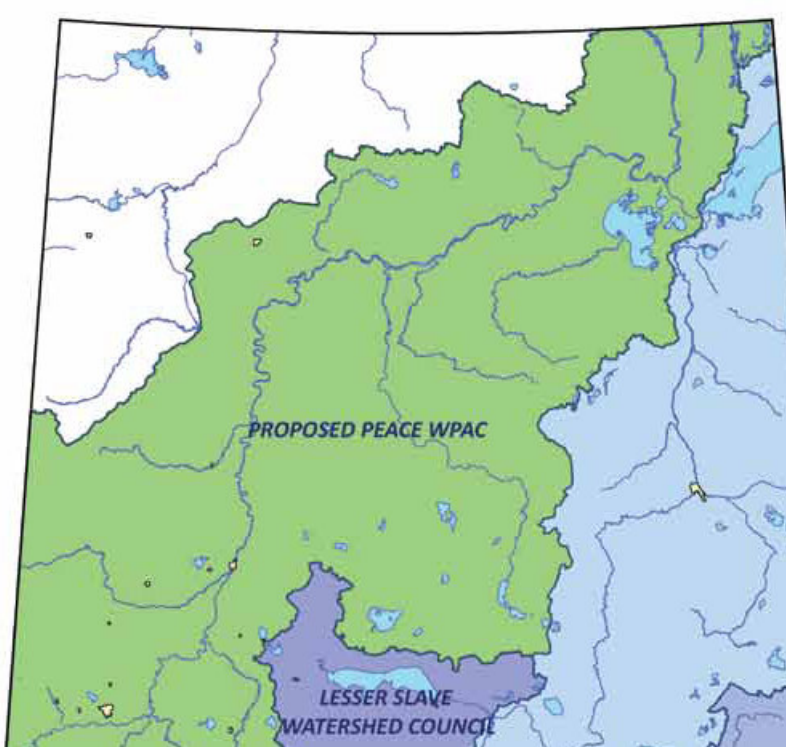


Figure 2.9 : Alberta Watershed Planning & Advisory Councils 2010

2.10 Federal Government

Government jurisdiction in some environmental aspects provides for overlapping responsibilities between the provincial and federal governments. This occurs in the areas of waterbody access (Navigable Waters), water quality/quantity monitoring, fisheries, migratory birds and at-risk species. Consequently, northwest Alberta falls within the following federal government geo-administrative jurisdictions:

- Navigable Waters -Transport Canada, Prairie and Northern Region
- Fisheries -Fisheries and Oceans Canada (DFO), Central and Arctic Region
- Water quality/quantity -Environment Canada, Water Survey of Canada, Prairie and Northern Region
- Migratory Birds and Species at Risk -Environment Canada, Canadian Wildlife Service, Prairie and Northern Region

3 Physical Conditions

The dominant physiographic feature of the region is the Western Plains which is situated between the ancient Canadian Precambrian Shield to the east and the younger disturbed belt of the Rocky Mountains and foothills to the west, as shown in Figure 3.1.

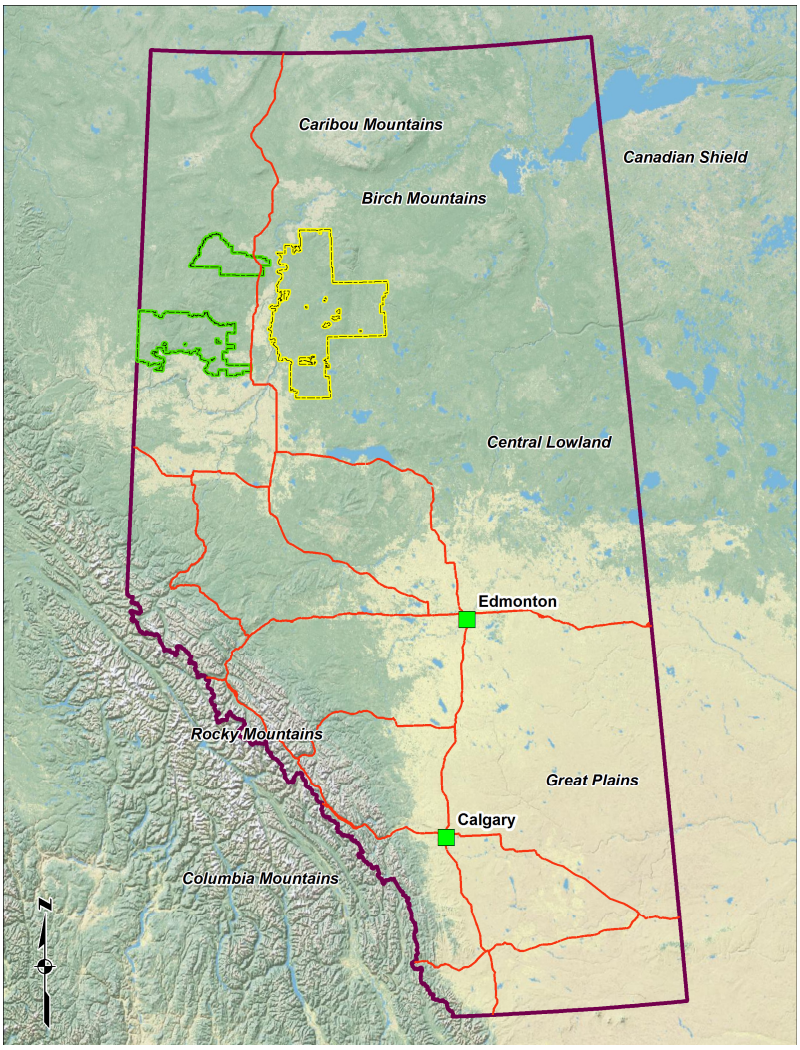


Figure 3.1 : Physiographic regions of Alberta .

The major structural geological elements that influence the character of northwest Alberta are the Canadian Shield, the Rocky Mountains and the foothills.

Under a Canadian physiographic classification, the DFA lies within Alberta's Peace River Lowland, Clear Hills Upland, Wabasca Lowland, and mid-Boreal Upland regions, as shown in Figure 3.2.

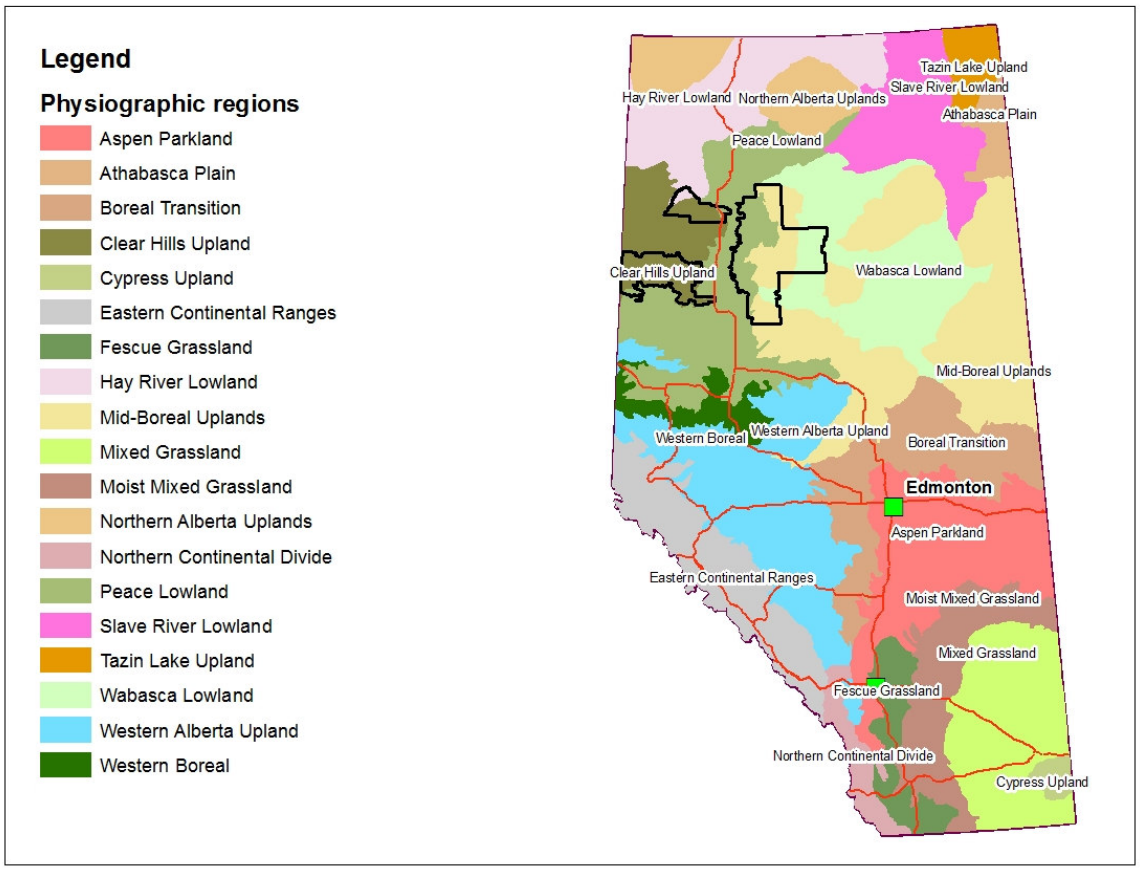


Figure 3.2 : Physiographic regions of Alberta –Version 2

Source : Agriculture and Agri-Food Canada, Soil Landscapes of Canada v2.2

At a finer resolution, the DFA falls within four natural subregions as depicted earlier in Figure 2.4 in the previous chapter. That chapter describes their climatological, soils and vegetative distinctions. An expanded summary of the biophysical characteristics of the four natural subregions in which the DFA is situated is presented in Table 3.1.

Table 3.1 : Summary of biophysical characteristics

Natural Subregion	Average Elevation (m above sea level)	Physiography	Major soils	Main Vegetation Types	Wet Lands and Water	Land Use
Dry Mixedwood	600 (225 – 1,225)	Undulating plains and hummocky uplands. Mainly till with significant lacustrine (Peace Lowlands)	Orthic and Dark Gray Luvisols. Brunisols on sands. Wetlands are Mesisols and Gleysols.	Much of the Natural Subregion has been cultivated. Aspen forests with shrubby understories, some white spruce, jack pine on dry sites. Peatlands common.	15% (wetlands). 3% (lakes, streams, not including Lesser Slave Lake).	Forestry, oil and gas, coal mining, recreation, grazing, till cropping in southern areas

Natural Subregion	Average Elevation (m above sea level)	Physiography	Major soils	Main Vegetation Types	Wet Lands and Water	Land Use
Central Mixedwood	525 (200 – 1,050)	Undulating plains, some hummocky uplands. Equal proportions of till, lacustrine, and fluvial materials.	Orthic Gray Luvisols. Brunisols on sands. Wetlands are mainly Mesisols, some Fibrisols, Gleysols	Closed-canopy mixedwood; aspen dominant in early seral stages, white spruce increasing with age; jack pine common on sandy sites; black spruce (tamarack stands) common on extensive peatlands	40% (wetlands, mainly peatlands); 3% (lakes and streams)	Forestry, oil and gas, coal mining, recreation, grazing in southern areas, minor till cropping, subsistence
Lower Boreal Highlands	675 (400 – 1,050)	Lower slopes of the Northern Alberta Highlands and undulating to hummocky uplands. Mainly till.	Orthic and Gleyed Gray Luvisols. Wetlands are mainly Mesisols with some Gleysols	Early to mid-seral pure or mixed forests (aspen, balsam poplar, black and white spruce, paper birch). Lodgepole pine–jack pine hybrids are common. Open black spruce peatlands; graminoid marshes and willow/marsh reed grass wetlands.	30% (wetlands, mainly in the Chinchaga area); 1% (lakes, streams).	Forestry, oil and gas, recreation, subsistence
Upper Boreal Highlands	825 (650 – 1,150)	Upper slopes and undulating plateaus of the Northern Alberta Highlands. Mainly till; seepage is common.	Orthic and Gleyed Gray Luvisols, some Brunisolic Gray Luvisols. Wetlands are mainly Mesisols and Organic Cryosols with some Gleysols.	Coniferous forests are dominant at all seral stages. Lodgepole pine–jack pine hybrids are common pioneers occurring with black spruce. Open black spruce stands on wetlands.	35% wetlands; 1-2% (lakes, streams).	Forestry, oil and gas, recreation, subsistence

Source : Naural Regions and Subregions of Alberta. 2006.

The physical conditions of the area will be discussed briefly under four sections, namely; topography, soils and land forms, hydrography and climate.

3.1 Topography

The land surface of northwest Alberta slopes to the northeast and is characterized by three major drainage basins: the Peace River, the Hay River, and the Slave River, as shown in Figure 3.3. Bordering the lowlands are several isolated upland islands that extend 300 to 1000 m above surrounding lowland areas, and include the Cameron Hills (450 to 800 m above sea level), the Caribou Mountains (450–1000 m a.s.l.), the Clear Hills (400–1050 m a.s.l.), the Buffalo Head Hills (400–900 m a.s.l.) and the Birch Mountains (350–800 m a.s.l.). A number of sub-dominant uplands also exist in the region commonly referenced in local forest operation planning due to challenges associated with access; Whitemud Hills, Halverson Ridge, Hawk Hills, Naylor Hills.

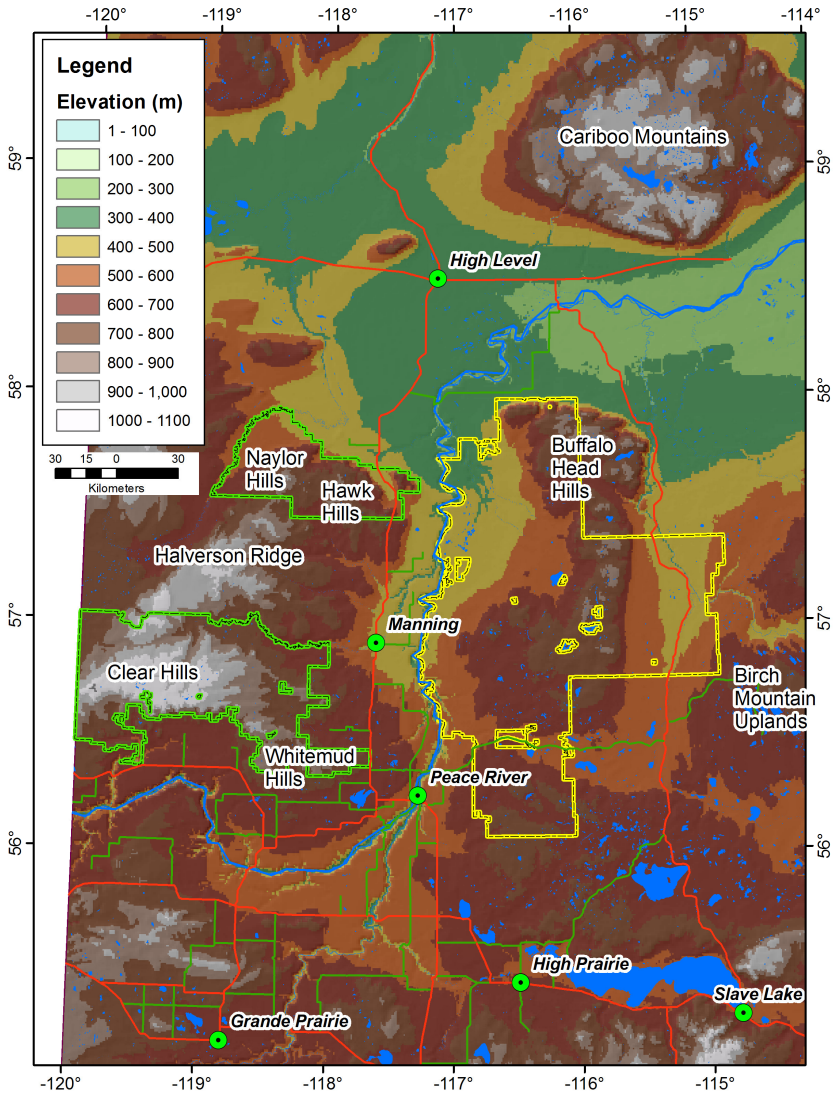


Figure 3.3 : Digital elevation model of northwest Alberta -major landforms

Because of the islanded nature of local uplands, the region has variable aspects and varying slope (%) including some areas of inoperable terrain, as well as north-facing slopes for which the climate characteristics and soils of the region present unique soils risks and reforestation challenges. This terrain variability is illustrated on the relief map in Figure 3.4.

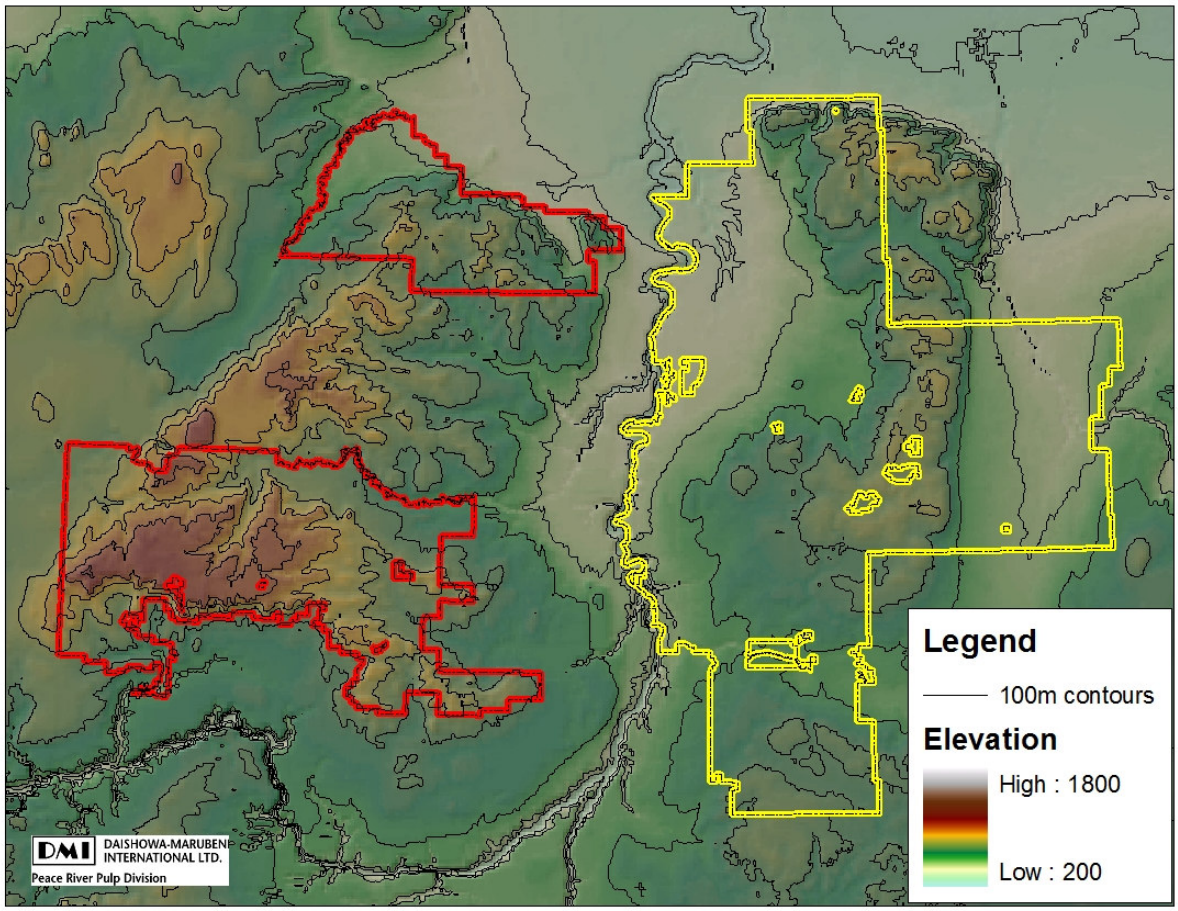


Figure 3.4 : Local Relief Map

Figure 3.5 illustrates some dominant local slopes in and around the DFA that are either too steep to operate or rugged enough to impact access costs and operating logistics severely.

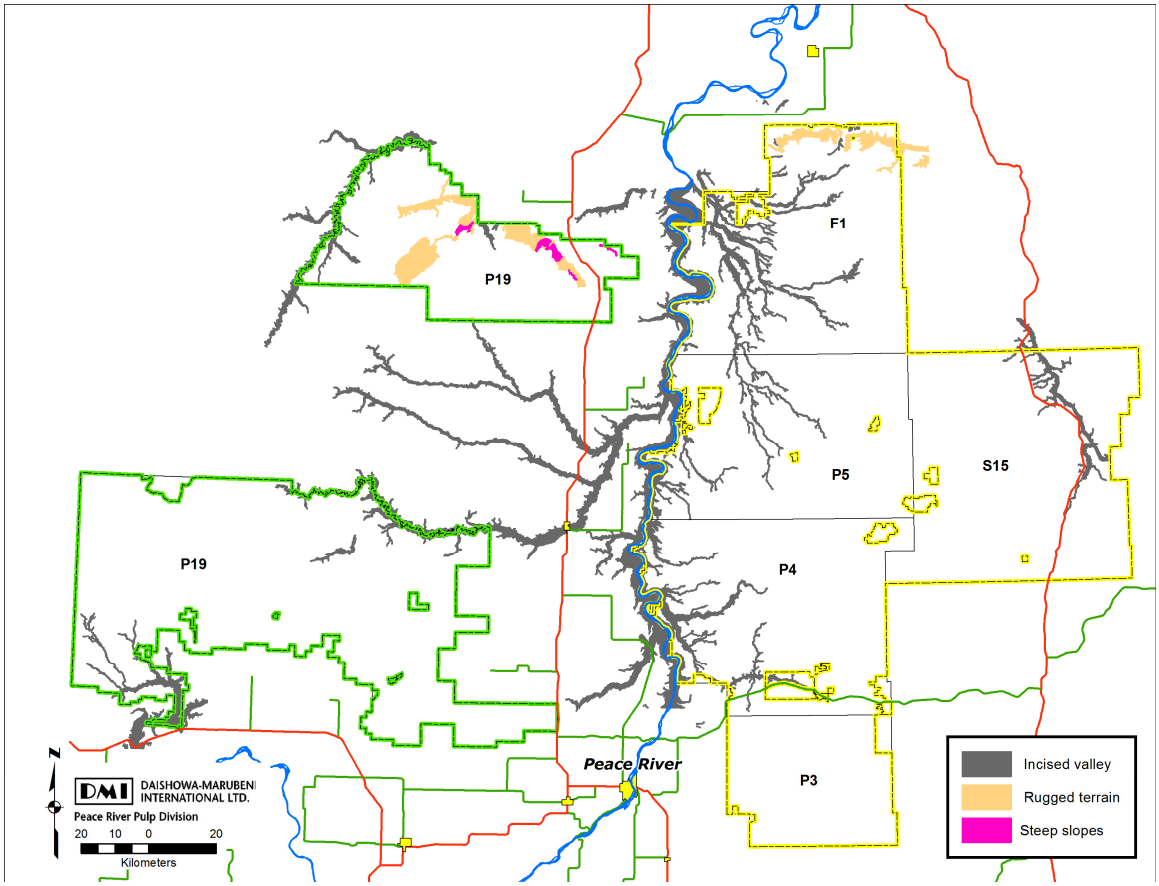


Figure 3.5 : Incised valleys and steep slopes in and around the DFA

3.2 Soils and Landforms

3.2.1 Soils

Soil conditions in northwest Alberta vary significantly depending on glacial history, local parent materials, climate, vegetation, and topography (Odynsky et al. 1956). Extensive discussion of glaciation influence on soils and landforms observed in the region is contained within the 1999 *Biophysical* document. Topography and de-glaciation imposed a strong influence on soil particle size, with finer-textured clay-dominated soils occurring in glacial lake basins, and clay/loams with some stoniness occurring in highland regions where glacial till prevails. The region also contains areas of well-drained sand-dominant soil or gravel associated with glacial history and riverine topography, and of course a number of poorly drained organic soil areas associated with large landbase portions containing wetlands (peatlands -fens, bogs). Soils along rivers, streams and wetlands are variable in composition, changing from coarse sands to silty loam to silty clay loam. Orthic Gray Luvisols are the dominant soil type throughout the FMA area, followed closely by organic soils (Figure 3.6).

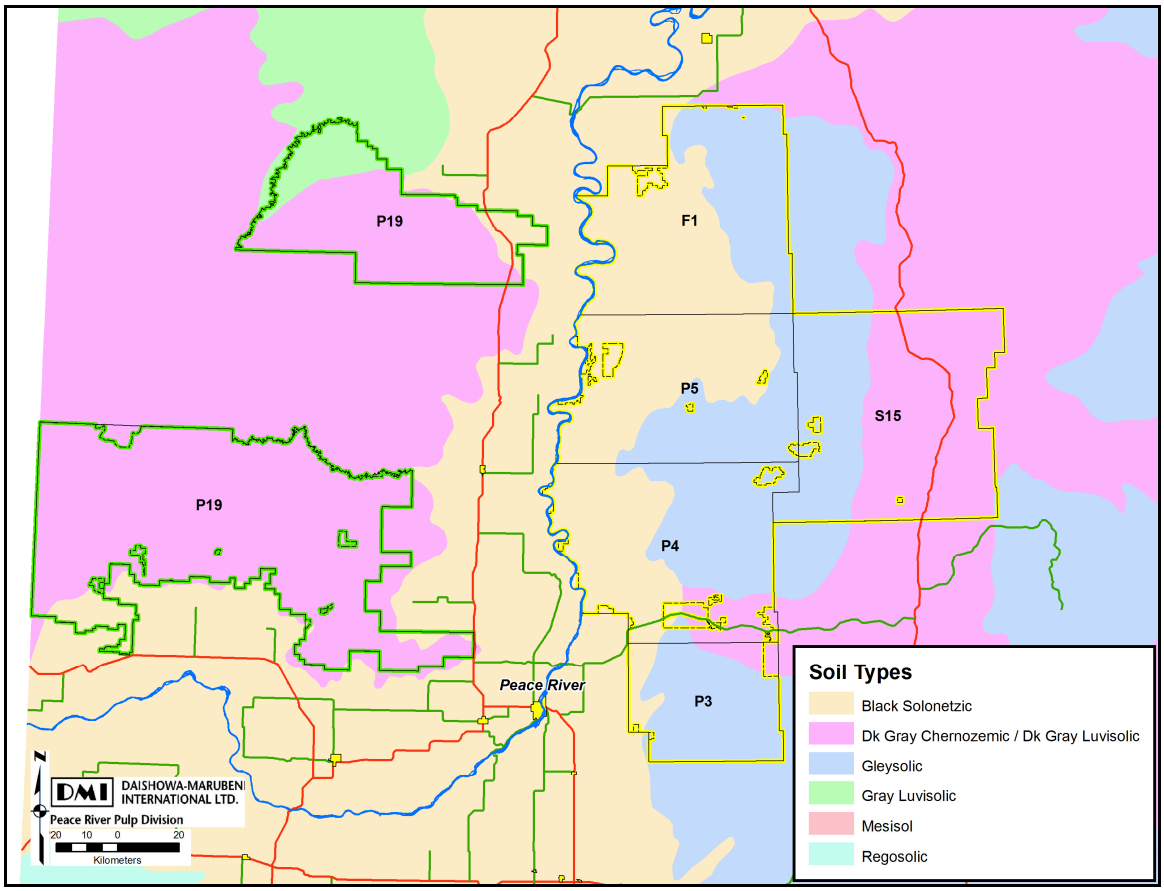


Figure 3.6 : Soils of northwest Alberta

Source : Agriculture and Agri-Food Canada (circa 1996)

3.2.2 Permafrost

Permafrost, or ground that remains frozen throughout the year, has been documented throughout much of the northern portions of each FMA area. In general, permafrost in northwest Alberta is found beneath bog complexes and is not found beneath fens or upland sites. Permafrost is common in more northerly latitudes but yields to degraded permafrost further south. Degraded permafrost areas are those sites that provide clear evidence of permafrost in recent geologic times, but have been degraded because of changes in climate or landform. Distribution and fine-scale classifications of permafrost in and around the DFA area (circa 1996) are shown in Figure 3.7. A coarser representation is provided in Figure 3.8. It follows as a logical possibility that the effect of climate change quantified through conservative warming trend models may cause continued degradation of local permafrost pockets during the current century.[8]

[8] Johnston, Mark H. (Mark Harvey) et al - Vulnerability of Canada's Tree Species to Climate Change and Management Options for Adaptation: An Overview for Policy Makers and Practitioners. 2009. (Canadian Council of Forest Ministers., ISBN 978-1-100-13196-2) 44pp.

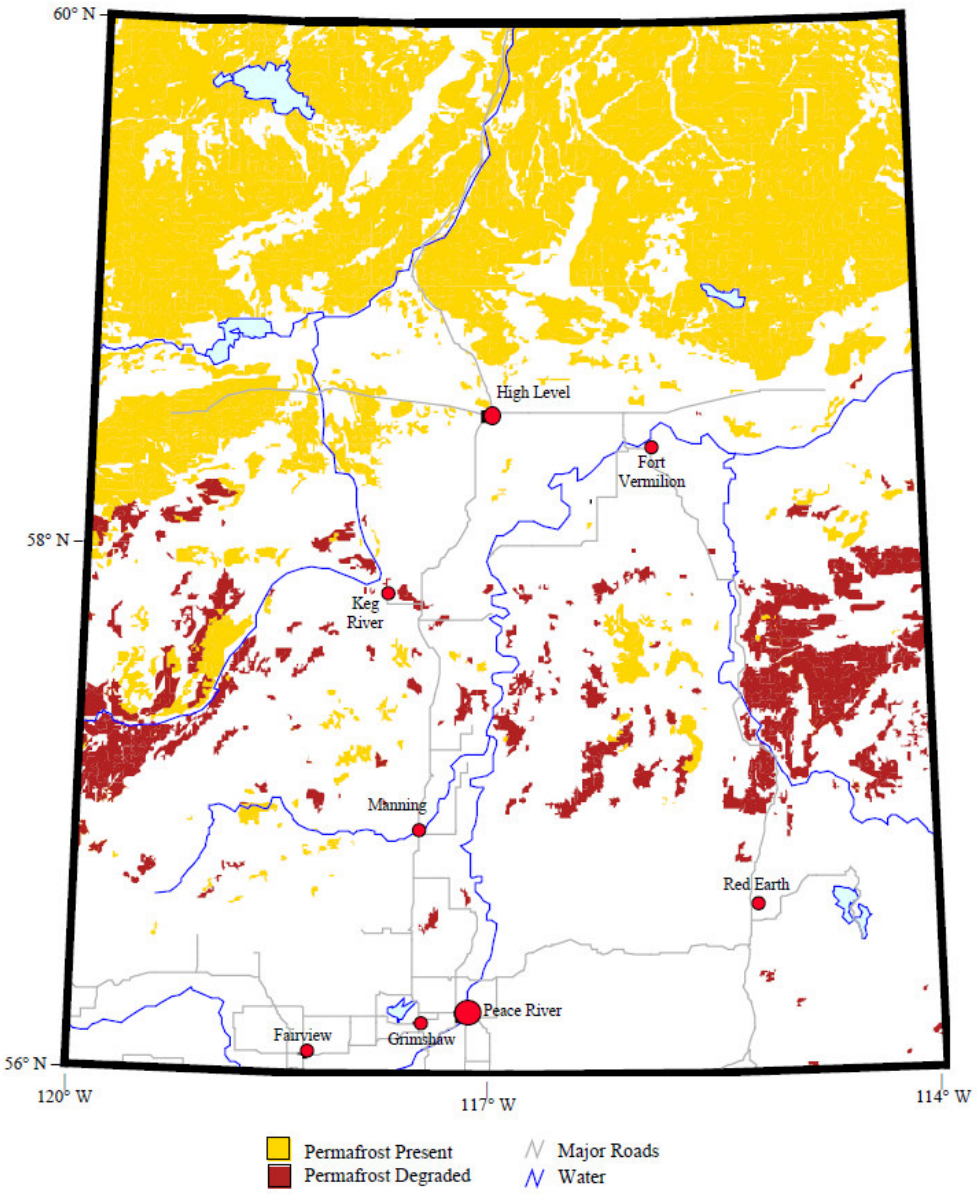


Figure 3.7 : Northwest Alberta Distribution of Permafrost (circa 1996)

Source: Modified from: Vitt et al. 1996. Peatland Inventory of Alberta Phase 1.

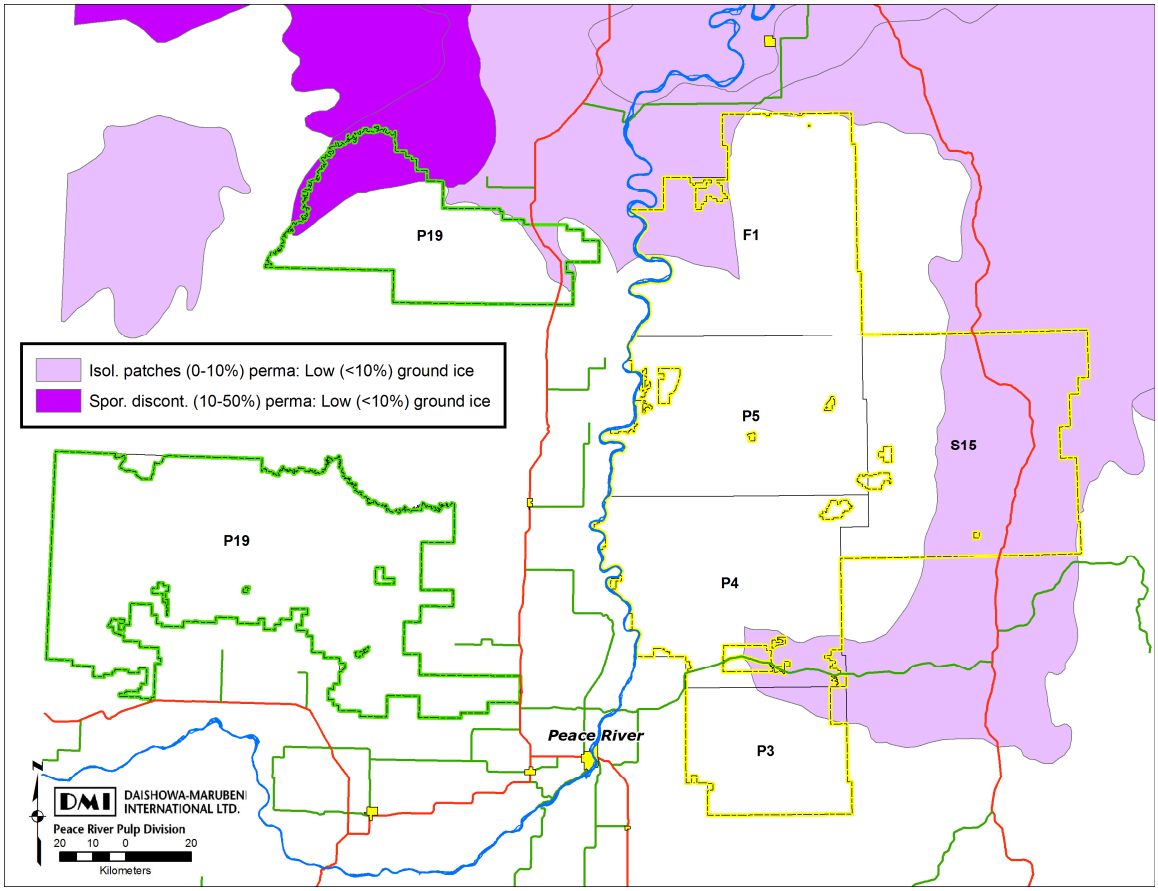


Figure 3.8 : Northwest Alberta distribution of permafrost.

Source : Agriculture and Agri-Food Canada (Second National Ecological Framework Report).

3.2.3 Landforms

Major landforms on the DFA are shown previously in Figure 3.3. They include the Clear Hills and Whitemud Hills in FMU P19 (south), the Naylor and Hawk Hills in FMU P19 (north) and the Buffalo Head Hills in FMU F1. The Peace River valley is the dominant waterway-associated landform coursing through this portion of the boreal plains.

3.3 Hydrography

This section summarizes the major drainage systems and water bodies either found on or that have an influence on the DFA area.

3.3.1 Major Drainage Basins

DMI's FMAs are almost completely within the Peace River drainage basin, with only small portions of the landbase falling in the Hay River basin in the North and the Athabasca River basin in the south (Figure 3.9). The catchment areas and monitoring sites used for assessment of water quality across the landbase are shown in in both Figure 3.9 and Figure 3.10 respectively. Data from these gauging stations are used as baseline data in watershed analyses of forest management scenarios.

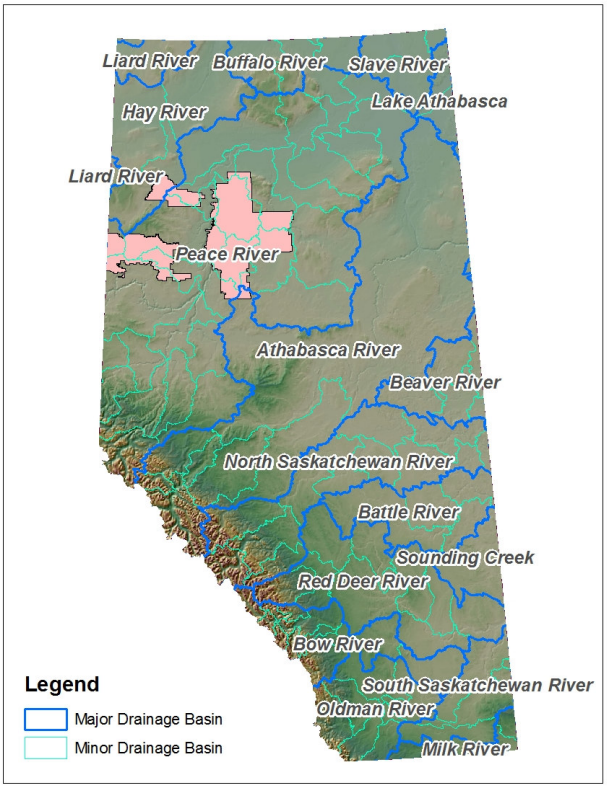


Figure 3.9 : Drainage basins of Alberta[9]

[9] Source: http://www.srd.alberta.ca/lands/geographicinformation/resourcedataproductcatalogue/drainbasins.aspx

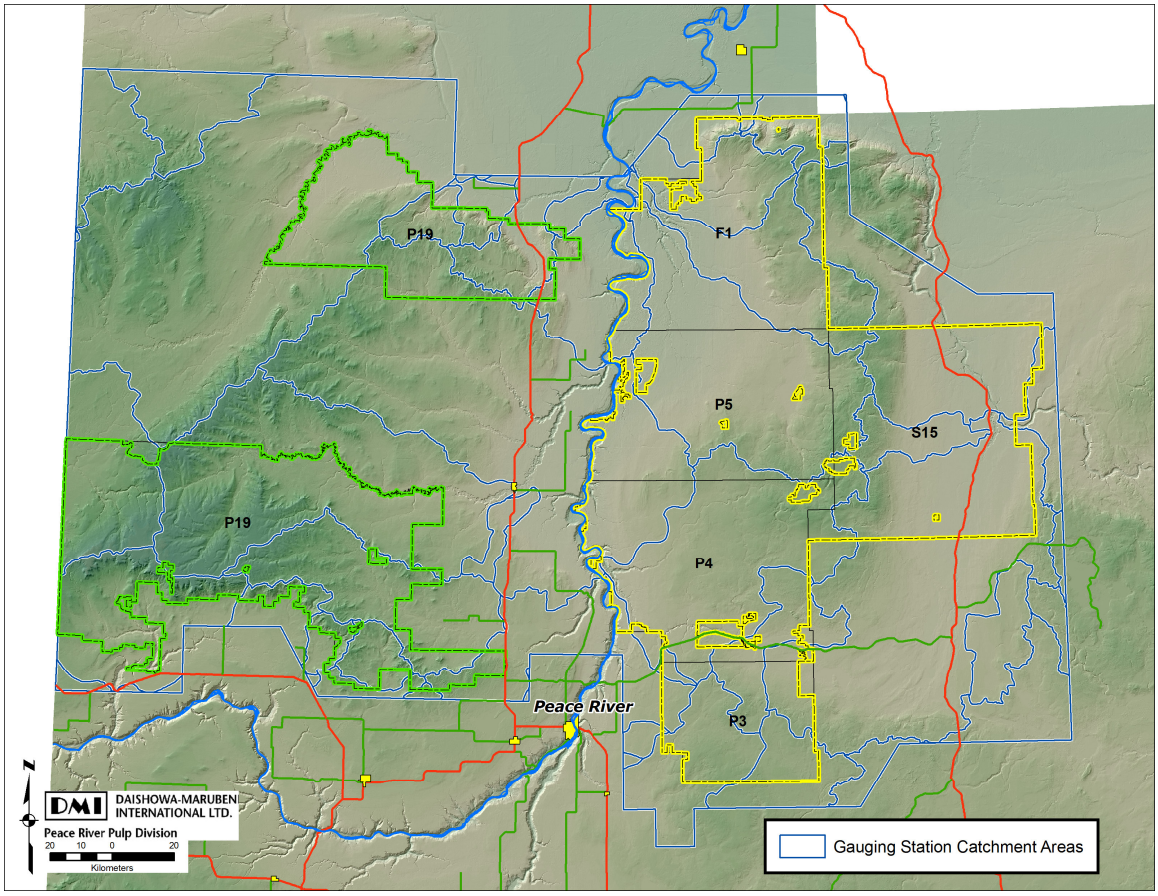


Figure 3.10 : Gauging station catchment areas on the DFA

Surface waters (and adjacent activities) in Alberta watersheds are monitored by several government departments (provincial and federal), industry, and stakeholder groups.[10] Such monitoring efforts provide controls and generate necessary data to evaluate water quality and aquatic ecosystem conditions. In particular, this approach of shared responsibility assists in managing cumulative effects and protecting this resource along with the ecosystems depending upon it. Basin-specific watershed analyses, water quality and water quantity remain areas of inventory and monitoring that are provided by Alberta as described in a 2010 Alberta directive on forest tenure roles and responsibilities (February 2010, Appendix 2 –Inventory and Monitoring).

Digital databases like the Long-Term River Network (LTRN) provide information as a general assessment of water quality at 28 network sites along the province's major river systems (Figure 3.11).[11] Those sites provide some representation of upstream and downstream conditions in locations of significant human activity. A larger number of lakes are also monitored with support from a variety of partnerships between government departments, an Alberta Lake Management Society, and the Regional Aquatics Monitoring Program. (Figure 3.12)[12]

[10] Alberta government., Water for Life: Facts and Information on Water in Alberta -2010 Revision
[11] Alberta government., Surface Water Quality Program –Monitoring Programs, LTRN (Ab ENV)
[12] Alberta government., Surface Water Quality Program –Monitoring Programs, Lakes (Ab ENV)

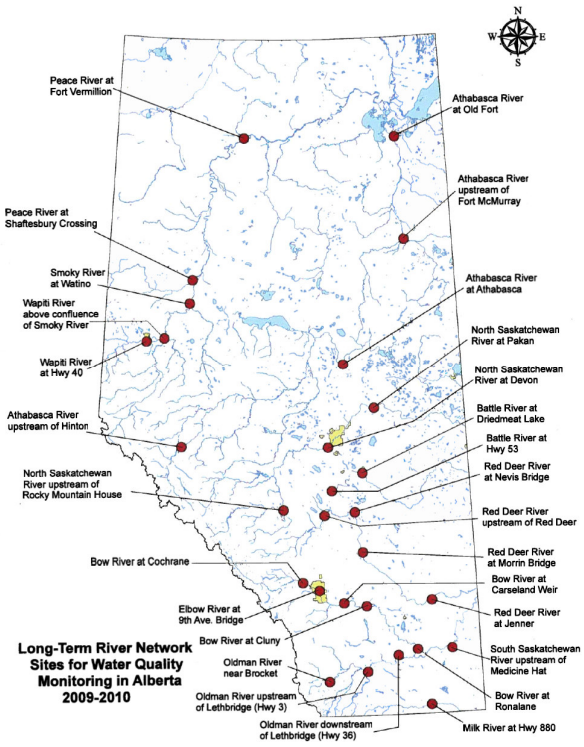


Figure 3.11 : Alberta river water quality monitoring sites.

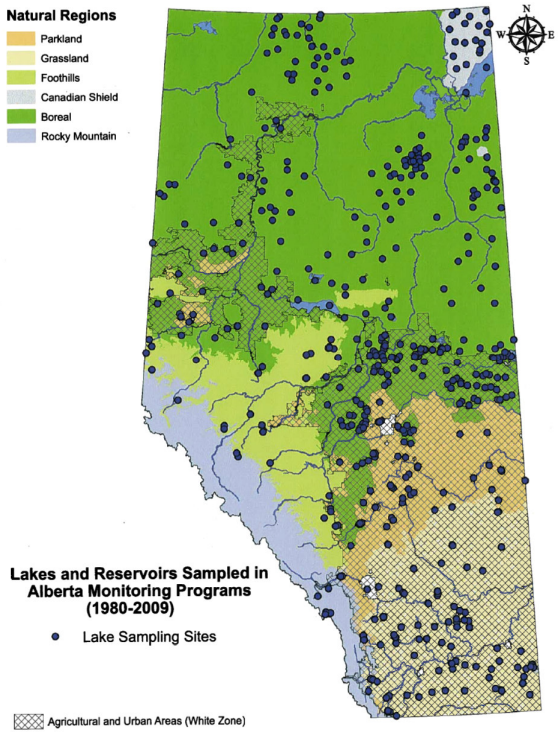


Figure 3.12 : Alberta lake monitoring sites.

3.3.2 Rivers and Streams (Lotic Systems)

The Peace River is the largest river in the area and forms the western border of the F1, P5 and P4 FMUs (Figure 3.13). The Peace River originates from the outflow of the Peace Canyon Dam near Hudson Hope, British Columbia and flows in a northeasterly direction across Alberta for about 1,034 km, from the Alberta-British Columbia border to its confluence with Riviere des Rochers and Chenal des Quatre Fourches, where the systems join to form the Slave River. The Peace River flows for most of its length through the Dry Mixedwood, Peace River Parkland and Lower Boreal Highland Natural Subregions.

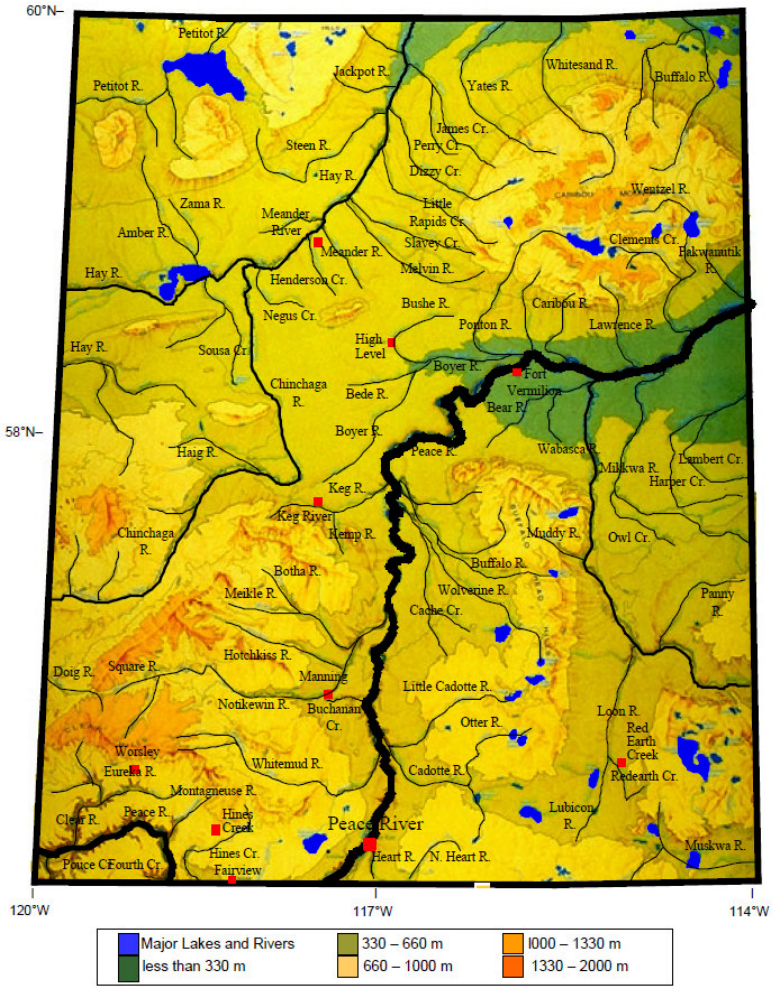


Figure 3.13 : Primary waterways in Northwest Alberta

The Smoky River is the largest tributary entering the Peace River, approximately 4 km upstream of the Town of Peace River. Other major tributaries to the Peace River within the region include the Clear River, Whitemud River, Notikewin River and Keg River from the west FMA, as well as the Cadotte and Little Cadotte Rivers, Wolverine River, Loon River and Wabasca River from the east FMA. The Westside FMA (P19 -north FMU) is also bordered by the Chinchaga River which flows north into the Hay River (Figure 3.14).

Water flow rates in the rivers of northwest Alberta are highly seasonal, with peak discharge occurring during April to June. Moderating spring temperatures melt the winter snowpack and lead to an initial freshet. Summer rainfall maintains moderate flow rates during July to August, after which flow rates quickly decline. Small to moderate sized rivers have low to absent flows during the winter months and in some years even by late summer to fall.

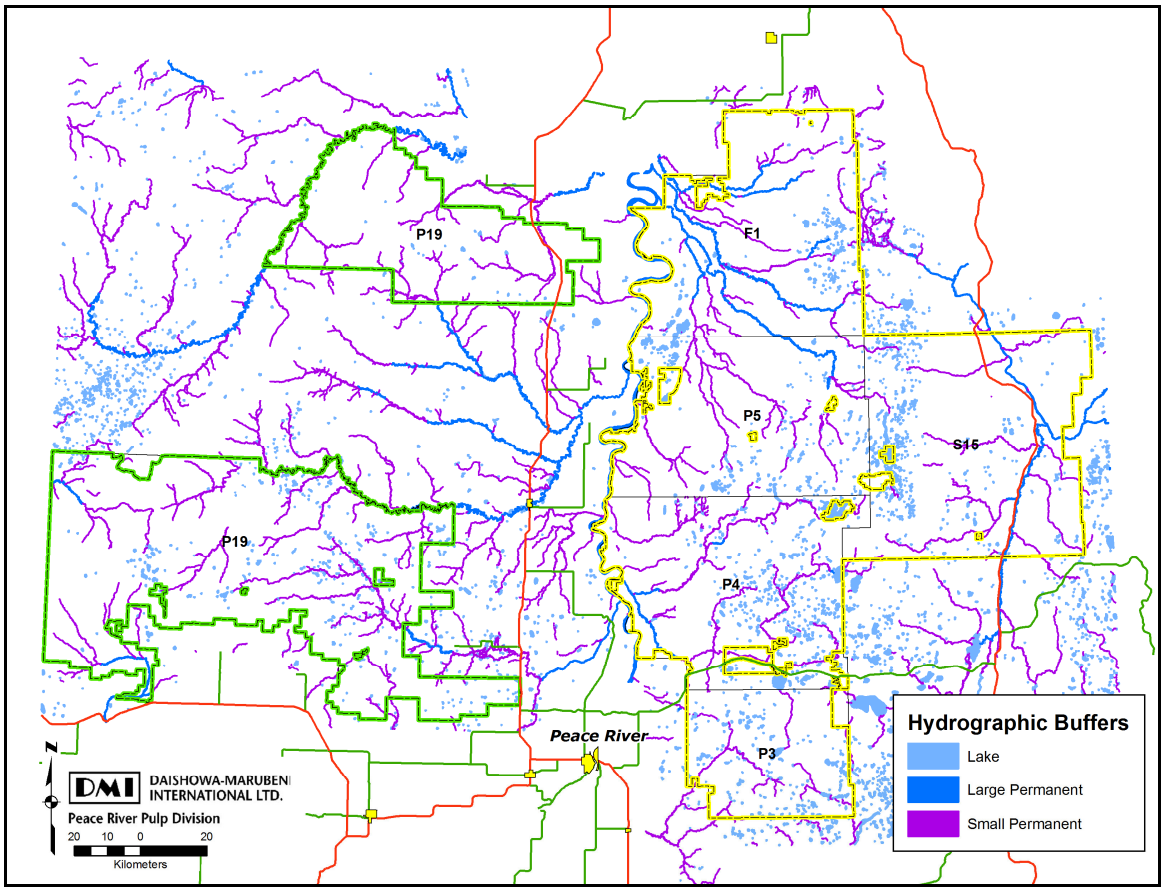


Figure 3.14 : Rivers and streams in the Forest Management Areas.

Spatial representation of waterways often focuses solely on the portion of a watershed network that is permanent in class (higher order watercourses) and readily captured by traditional remote sensing. Since the time of the 1999 *Biophysical* synopsis, some new technologies have surfaced which significantly improve the detection and mapping of lower order watercourses (intermittent and ephemeral), as well as wetland features. These tools include Wet Areas Mapping (WAM)[13] and LiDAR[14]. Figure 3.15 illustrates a side-by-side comparison of the spatial hydrology outputs from traditional remote sensing, WAM, and improved detail through LiDAR on a sample portion of local landscape. In northwest Alberta these projects are actively (2010) advancing the spatial record and quantification of these unique hydrographic features in coverages that include the DFA and eventually broader in geographic scope. The size of the DFA does not permit a larger scale figure to demonstrate the full proportion that these features represent across local boreal landscapes.

[13] University of New Brunswick, Dr. Paul Arp lab
[14] Alberta Sustainable Resource Development, LiDAR-based Wet Areas Mapping project

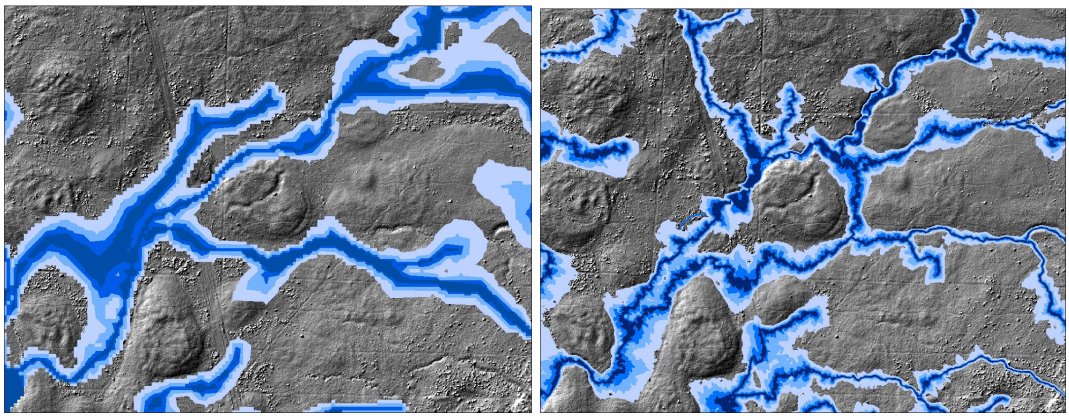


Figure 3.15 : Sample Lower Order Watercourses: Map Technology Advances

DEM-based Wet Areas Mapping (left), LiDAR-based Wet Areas Mapping (right)

3.3.3 Lakes

Although sloughs, fens and bogs are common throughout northwest Alberta, lakes are relatively scarce. With a few exceptions, DFA area lakes are shallow with average depths generally under 10-meters, and commonly 5-meters or less. Boreal waterbody chemistry is commonly influenced by the region's peatlands which lends to lakes with lower pH than those in other regions and dark brown color caused by dissolved organic carbon. Waterbodies with physical characteristics and chemistry supporting small forage species of fish are common in the region, while sport-fishery lakes are fewer.

Named lakes in and around the DFA include the following:

- Eastside FMA: Carmon, Cadotte, Donaldson, Jackpine, Little Buffalo, Russell, Sawn, Haig, Otter, Seal, Bison, Simon, Golden Lake
- Westside FMA: Cub, Montagneuse, Ray, Running, South Whitemud, Sulphur, Stoney, Twin Lake.

A large number of unnamed smaller waterbodies also exist. The largest lake within the northwest region is Bistcho Lake (41,019ha) while the largest within the DFA is Bison Lake. The locations of lakes that exceed 200 hectare size are shown in Figure 3.16.

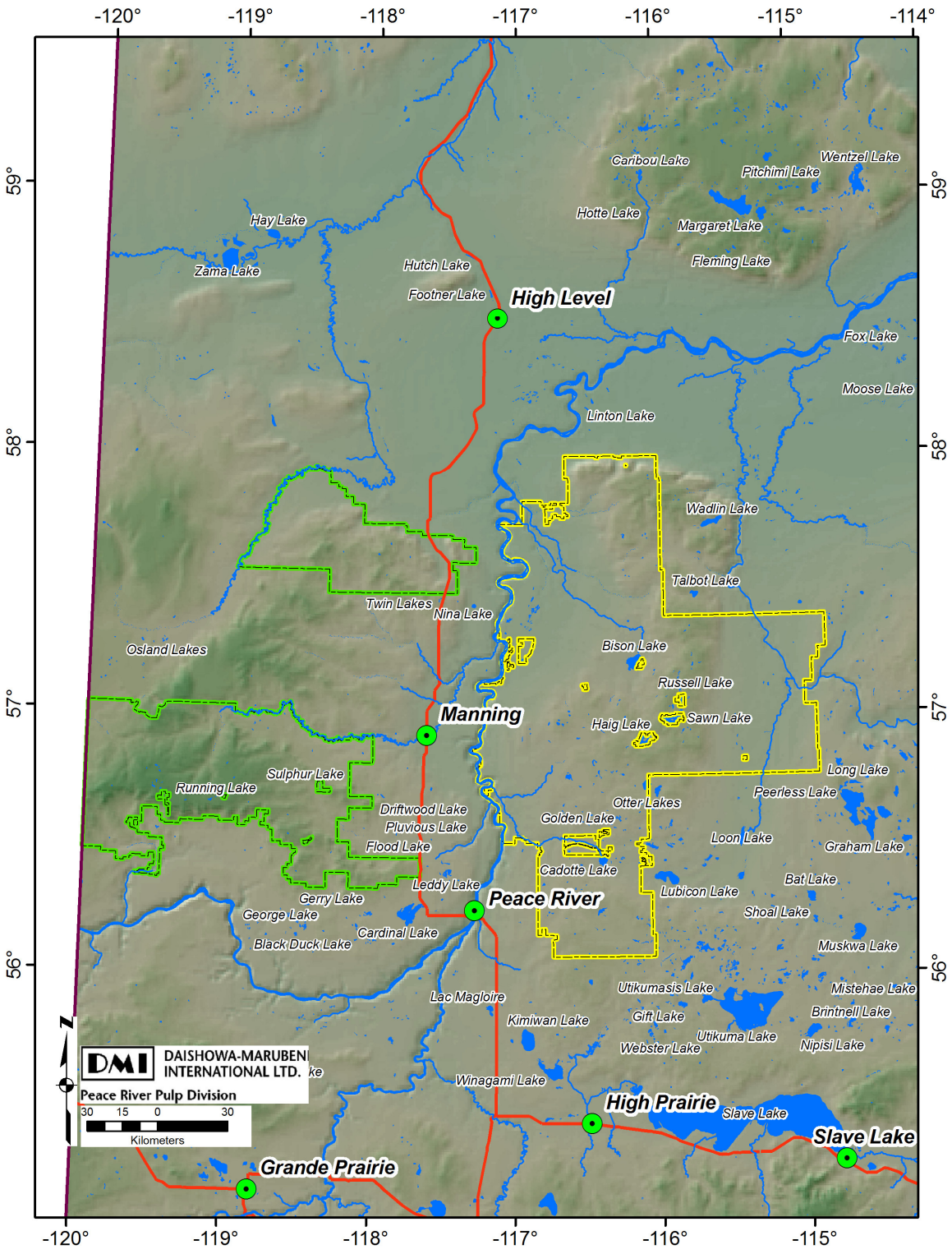


Figure 3.16 : Major lakes in northwest Alberta

3.3.4 Flood Prone Watersheds

A number of forested land areas in northwestern Alberta are comprised of higher elevation hill complexes with moderate topographic relief. These hill complexes include

the Whitemud Hills, Clear Hills, Hawk Hills, Naylor Hills, Buffalo Head Hills, and Caribou Mountains. Generally, there is an area of relatively flat tableland between these hill complexes and the mainstem rivers; the Peace and Hay. Most human settlements and agricultural development have been established by historical clearing of forests on these tablelands between the hill complexes and the primary rivers.

Watershed drainage originates in the forested headwaters of streams in the higher elevation areas. Generally the relief and soil properties in these hill complexes resulted in deeply incised stream channels, with moderate gradient, which inherently limit the area affected by flooding along these watercourses during high water events. However once these waterways reach the tablelands between the hills and the river valleys, stream channels are generally low gradient and poorly incised, resulting in relatively low channel capacity. The flat nature of the adjacent landscape results in flooding, which can affect significant areas of farmland and other human developments. Flood-prone areas on the DFA are illustrated in Figure 3.17.

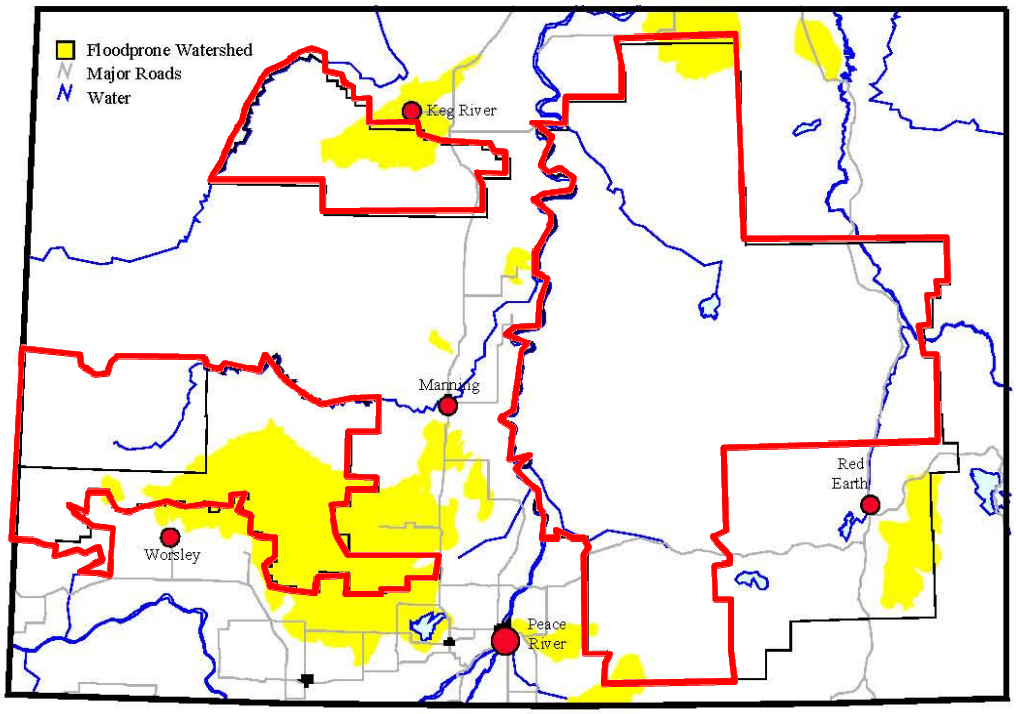


Figure 3.17 : Location of flood prone watersheds

3.3.5 Groundwater

In the Peace River area[15], the primary groundwater source is known as the Grimshaw Gravels aquifer and capable of yields exceeding 655 cubic metres per day (100 imperial gallons per minute (igpm)). Sandstone lenses of the Dunvegan Formation is another source capable of yields approximating the range of 165 - 655 m3/day (25 - 100 igpm). Water chemistry (*i.e.* quality) is generally good within the Grimshaw Gravels but more variable within the Dunvegan Formation.

[15] Alberta government., Water for Life: Facts and Information on Water in Alberta -2010 Revision

Alberta monitors this resource through a network of over 250 wells across the province known as the Groundwater Observation Well Network (GOWN).[16] Approximately 200 of these wells continually monitor groundwater levels, and 160 focus on water quality sampling. Nine (9) monitoring wells fall within northwest Alberta. Alberta Environment and the Alberta Geological Survey share a mandate to map and assess the state of groundwater in Alberta through a multi-year program building on existing datasets with new technologies to lend baseline data support to the Province's Water for Life initiative.[17] One of the goals of this active program is to map and classify groundwater resources for the entire province. At present no complete sub-surface mapping was to be available for northwest Alberta or the DMI DFA.

3.4 Climate

Climate is the total of all statistical weather information that describes the variation in weather at a given place for a specific interval of time (Greer 1996). In common usage, climate is the synthesis of weather: the weather at some location averaged over a specified time period (typically 30 years) plus information on weather extremes recorded during the same period, or for the entire period of record. Several factors control the climate at any one location, including variations in solar radiation due to latitude, distribution of continents and oceans, pressure and wind systems, ocean currents, major terrain features, and local features.

The overall climate for northwest Alberta is *continental*, with warm summers and cold winters and large contrasts in temperature between day, night, winter and summer characteristic of this designation. Alberta is in a zone of influence referred to as the westerlies, which means low and high pressure systems move from west to east, as is typical at the western edges of continents. For seven to eight months of the year, the air transport in northwest Alberta is from the west, which might be expected to bring moist air from the Pacific. However, most of the moisture is lost when the air passes over the Coastal Mountain Range and the Rocky Mountains, thereby giving the region its drier continental climate.

3.4.1 Temperature

The mean annual temperature for northwest Alberta varies from just above 0°C in the south to -2.5° C in the north (Figure 3.18).

[16] Alberta government., website: http://www.environment.alberta.ca/apps/GOWN
[17] Alberta Geological Survey., Alberta Groundwater Mapping and Inventory Program

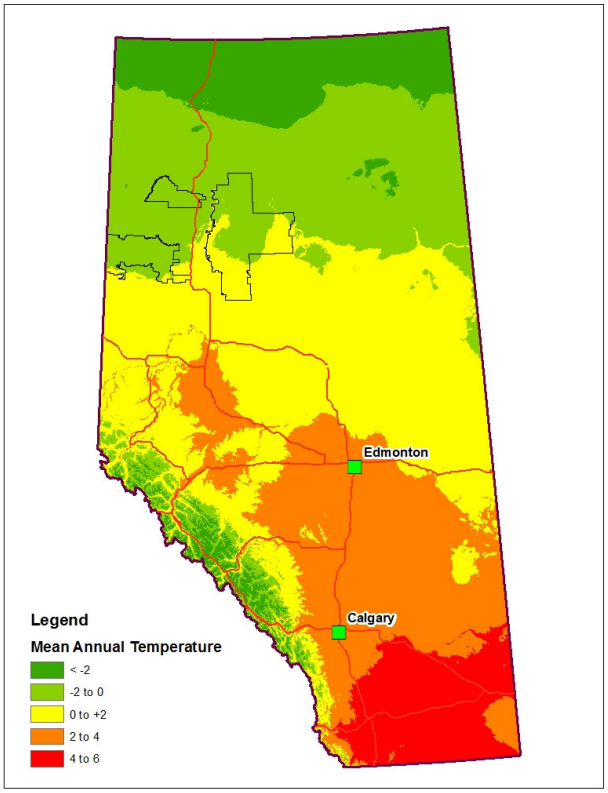


Figure 3.18 : Mean annual temperature across Alberta (°C)

Source : Alberta government -ASRD climate normals 1961-1990

Five geographic centers were selected to illustrate climate statistics across a gradient of northwest Alberta landscape; Rainbow Lake, High Level, Keg River, Wabasca River, Peace River. Average temperature and precipitation data for the 30-year period from 1961 to 1990 for these select locations in and around the DFA area are presented in Table 3.2.

Table 3.2 : Average climatic data for selected locations in the vicinity of the DFA

Source : Biophysical document, p 2-53. (1961-1990 period)

Meteorological Station	Month	Mean Daily Max Temp °C	Mean Daily Min Temp °C	Mean Daily Avg Temp °C	Extreme Daily Max Temp °C	Extreme Daily Min Temp °C	Total Degree Days > 5°C Days	Mean Total Rainfall mm	Mean Total Snowfall cm
High Level	Jan	-15.56	-26.88	-21.15	1.51	-41.49	0.00	0.30	26.73
High Level	Feb	-11.10	-24.45	-17.71	5.84	-38.49	0.30	0.32	21.37
High Level	Mar	-2.84	-17.35	-10.04	9.44	-33.69	0.00	0.26	21.66
High Level	Apr	8.77	-4.90	1.97	20.61	-18.66	27.80	7.92	8.67
High Level	May	16.91	2.40	9.66	27.09	-4.50	155.26	33.69	6.71
High Level	Jun	21.06	7.39	14.25	28.53	0.62	277.49	66.37	0.00
High Level	Jul	22.82	9.34	16.09	29.57	3.02	344.17	61.51	0.00
High Level	Aug	20.94	7.21	14.10	29.29	-0.31	282.45	54.75	0.12
High Level	Sep	14.55	1.53	8.06	23.42	-5.40	109.75	32.61	2.84
High Level	Oct	5.79	-4.42	0.73	18.01	-15.63	17.88	12.92	20.40
High Level	Nov	-7.96	-17.30	-12.55	5.73	-32.21	0.21	0.64	32.78
High Level	Dec	-14.79	-25.67	-20.15	2.01	-40.11	0.06	0.43	26.58
Keg River	Jan	-12.07	-23.98	-17.93	3.88	-39.54	0.00	0.56	25.87
Keg River	Feb	-7.51	-21.73	-14.58	9.42	-36.63	0.51	0.25	17.64
Keg River	Mar	0.59	-14.75	-7.03	13.86	-31.00	0.97	0.29	17.23
Keg River	Apr	10.39	-4.48	3.09	21.39	-14.78	33.21	9.12	17.58
Keg River	May	16.91	1.16	9.04	26.43	-5.65	129.20	29.48	3.10
Keg River	Jun	21.14	5.51	13.35	28.40	-1.25	250.79	67.06	0.20
Keg River	Jul	22.51	7.63	15.05	29.38	1.21	312.47	64.38	0.00
Keg River	Aug	20.98	5.86	13.44	29.27	-1.71	264.61	66.14	0.00
Keg River	Sep	15.32	0.92	8.20	24.43	-5.58	113.59	32.96	3.01
Keg River	Oct	7.55	-5.01	1.21	19.53	-14.45	30.96	11.01	18.79
Keg River	Nov	-7.88	-19.71	-13.90	7.80	-33.55	0.25	1.12	29.61
Keg River	Dec	-10.23	-22.42	-16.25	5.50	-38.15	0.22	0.28	18.52
Peace River	Jan	-12.60	-23.29	-17.10	3.60	-38.58	0.00	0.48	23.28
Peace River	Feb	-7.68	-18.93	-13.07	4.88	-35.10	0.10	0.38	22.43
Peace River	Mar	-1.21	-13.39	-7.03	9.28	-29.29	0.57	0.50	17.08
Peace River	Apr	9.17	-3.45	2.99	19.59	-14.94	29.01	8.44	8.54
Peace River	May	16.77	2.80	9.83	26.35	-4.55	158.89	27.91	3.13
Peace River	Jun	20.58	7.27	14.02	27.92	1.24	271.61	58.60	0.00
Peace River	Jul	22.64	9.23	15.99	29.86	3.97	341.52	58.63	0.00
Peace River	Aug	21.17	7.82	14.65	29.50	1.28	298.25	49.74	0.12
Peace River	Sep	15.51	2.95	9.26	24.31	-4.64	139.67	35.67	2.02
Peace River	Oct	8.79	-2.41	3.23	19.81	-12.26	40.53	12.71	10.60
Peace River	Nov	-3.85	-13.28	-8.31	8.92	-27.05	0.51	3.23	22.07
Peace River	Dec	-9.86	-20.02	-14.63	4.73	-35.54	0.03	0.49	23.22
Rainbow Lake	Jan	-10.82	-20.76	-15.72	2.75	-36.13	0.00	0.07	23.40
Rainbow Lake	Feb	-7.11	-20.10	-13.53	7.94	-36.85	1.77	0.05	14.78
Rainbow Lake	Mar	-1.28	-15.70	-8.45	9.34	-29.28	0.00	0.25	22.21
Rainbow Lake	Apr	9.89	-4.58	2.49	18.58	-8.98	25.26	6.15	10.67
Rainbow Lake	May	16.09	2.88	9.52	25.98	-4.13	131.61	41.47	4.16
Rainbow Lake	Jun	19.67	7.17	13.46	27.58	0.80	249.03	75.80	0.00
Rainbow Lake	Jul	21.37	8.97	15.19	28.77	3.32	305.61	80.79	0.00
Rainbow Lake	Aug	20.08	7.39	13.74	28.24	0.86	240.14	67.12	0.07
Rainbow Lake	Sep	14.19	2.53	8.18	23.19	-3.88	85.50	41.87	2.46
Rainbow Lake	Oct	6.50	-4.27	1.20	18.78	-8.95	8.07	8.32	8.96
Rainbow Lake	Nov	-5.23	-15.84	-10.44	8.11	-29.69	0.00	0.00	24.55
Rainbow Lake	Dec	-6.60	-17.72	-12.05	5.63	-30.88	0.20	0.00	16.60
Wabasca River	Jan	-11.28	-22.73	-16.94	4.48	-38.11	0.00	0.23	24.38
Wabasca River	Feb	-5.71	-19.72	-12.71	8.65	-35.75	0.41	0.23	17.80
Wabasca River	Mar	0.23	-13.64	-6.66	10.79	-28.37	0.28	0.94	18.75
Wabasca River	Apr	9.41	-3.50	2.90	19.37	-14.44	29.90	10.32	8.49
Wabasca River	May	15.09	3.06	9.09	24.98	-4.56	153.60	41.78	2.37
Wabasca River	Jun	20.01	8.83	14.42	27.64	2.38	289.28	78.77	0.00
Wabasca River	Jul	21.71	10.91	16.33	28.31	5.56	354.71	89.06	0.00
Wabasca River	Aug	21.04	9.52	15.31	28.35	1.94	311.93	53.24	0.00
Wabasca River	Sep	14.29	4.04	9.36	23.42	-3.03	147.12	44.65	1.88
Wabasca River	Oct	8.29	-1.21	3.56	18.67	-10.17	32.31	16.76	6.71
Wabasca River	Nov	-2.59	-12.07	-7.27	8.75	-25.69	0.63	1.67	18.97
Wabasca River	Dec	-9.05	-19.65	-14.30	5.02	-34.08	0.03	1.18	24.03

July and January are the warmest and coldest months respectively, for all locations, as shown in Figure 3.19. While summers are relatively the same between the areas, High Level stands out as the coldest.

A broader range of years reveals the region's coldest extreme minimum broached -50°C at Keg River, Manning, Wabasca and Worsley (1996), and the warmest extreme daily maximum at +36.7°C for Peace River (1945).[18]

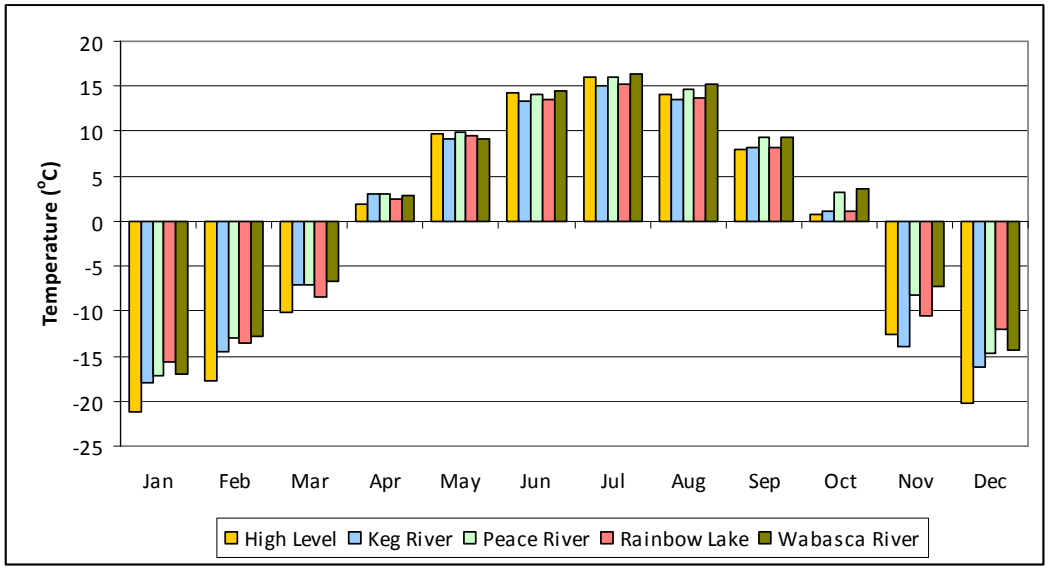


Figure 3.19 : Mean daily average temperatures by month for selected locations

Growing degree days and frost-free days are two other temperature summaries that are often reported because they strongly affect crop production. Growing degrees for a given day are the number of degrees that the mean temperature is above 5°C, a temperature that is considered critical for most crop growth. If the mean temperature on a given day is 8°C, 3 growing degree days are recorded for that date. Frost-free days are those in which the minimum temperature is not less than 0°C, at which many crops would die.

As shown in Figure 3.20, the cumulative average annual growing degree days (>5 deg C) for the selected locations. Wabasca River, Peace River and High Level all have over 1,200 annual growing degree days, while Rainbow Lake has the lowest for the region, a reflection of its cooler summers. The average frost free period for the region historically ranged from 54 to 115 days (Environment Canada 1982), although frost can occur in any month of the year in this region.

[18] Source: The Weather Network (http://www.theweathernetwork.com/statistics) –record daily highs and lows

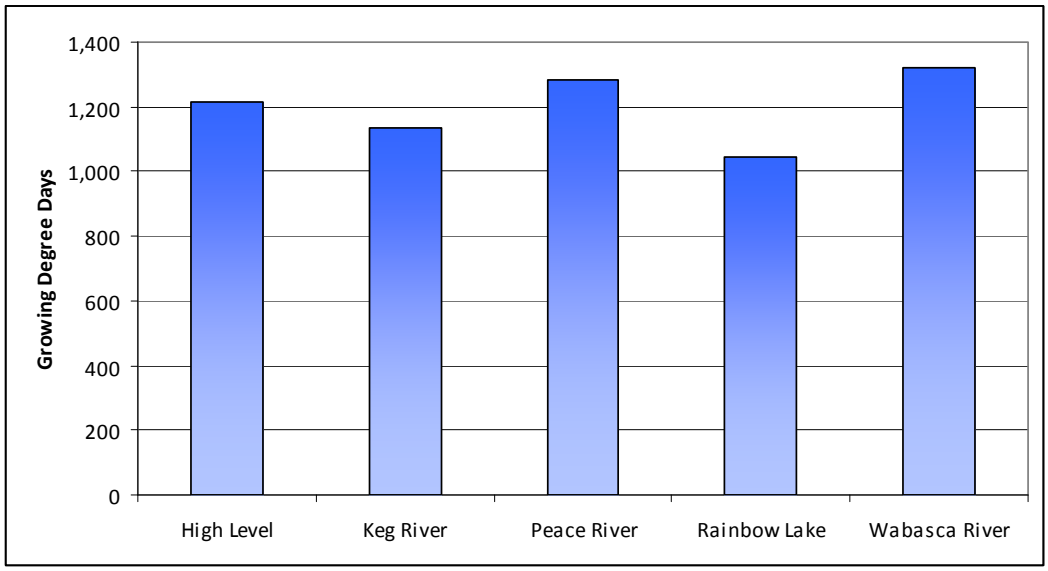


Figure 3.20 : Cumulative annual growing degree days for selected locations

The growing season for the DFA ranges from 160-180 days (Figure 3.21) and the start of growing season is April 17 to April 23 (Figure 3.22). As seen in the figures, the growing seasons are increasing to the north over time and may be evidence of climate change and things to come. It is interesting to note the contraction in land area subject to available growing days less than 160 between the 30-year periods 1961-1990 and 1971-2000. The DMI DFA dominantly lies within zones of 165 to 180 growing days.

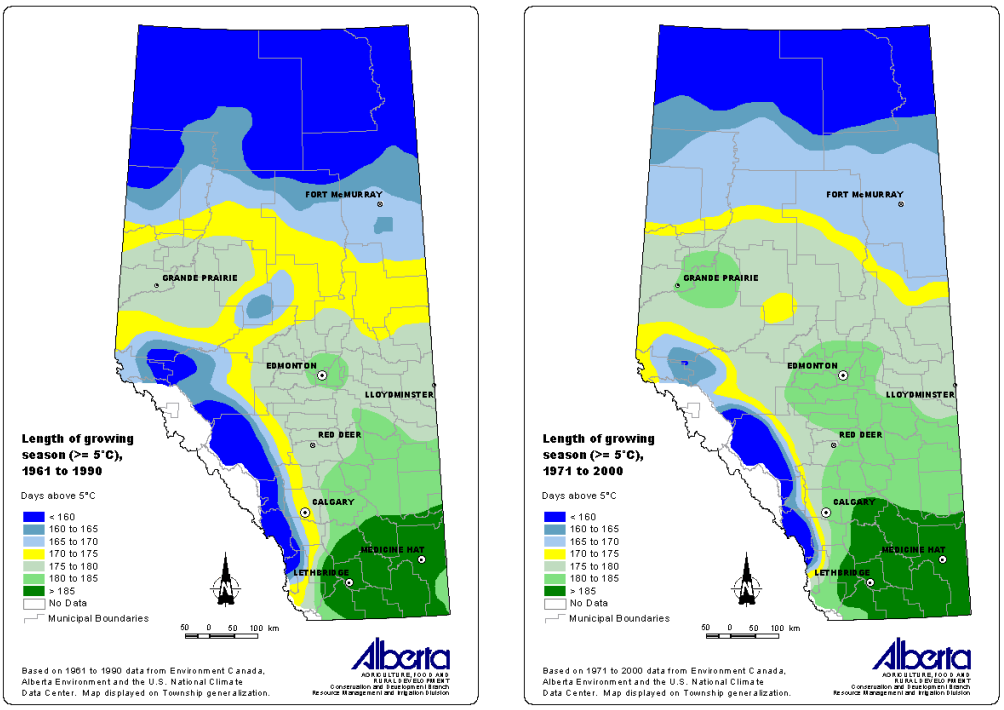


Figure 3.21 : Length of Growing Season (days >= 5 deg C) 1961-2000

Source: Government of Alberta –Agriculture and Rural Development

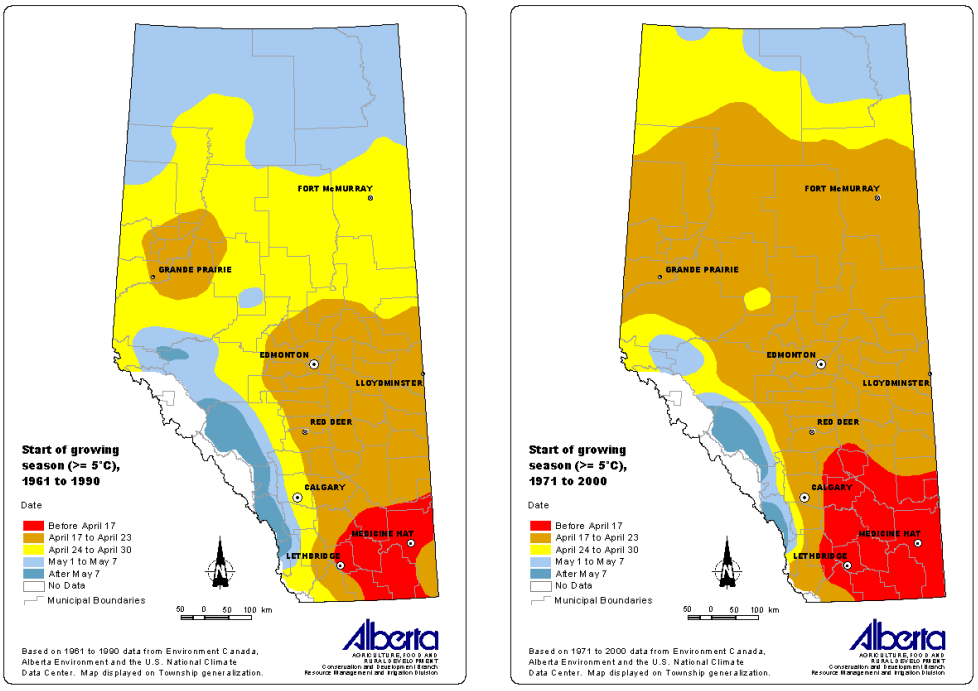


Figure 3.22 : Start of Growing Season (>= 5 deg C) 1961-2000

Source: Government of Alberta –Agriculture and Rural Development

illustrates the general start-point to the growing season for northwest Alberta depending on longitudinal position (based on an average daily temperature of 5°C or higher for five consecutive days). It is interesting to note the expansion in land area with growing season temperatures arriving April 17-23 relative to the former 1961-1990 period. By air temperatures, the DMI DFA gained an average of 5-days spring growing season length in the 1971-2000 period.

Figure 3.23 illustrates the general end-point to the growing season for northwest Alberta depending on longitudinal position (based on an average daily temperature of less than 5°C after July 1). Little marked difference exists in FMA fall temperature zonation between the two 30-year periods, as the DMI DFA generally sees the end of all plant growth between October 1 and 14. Some earlier advancement of cold temperature zones is notable however for the northern and southern thirds of the province in comparing the historical 1961-1990 and 1971-2000 periods.

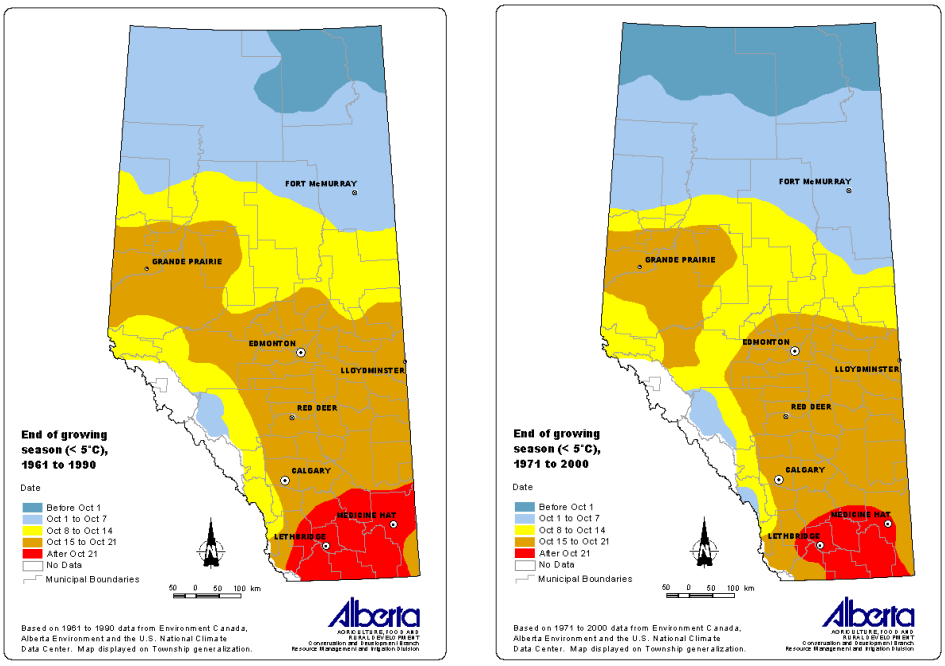


Figure 3.23 : End of Growing Season (< 5 deg C) 1961-2000

Source: Government of Alberta –Agriculture and Rural Development

3.4.2 Precipitation

The average monthly rain and snowfall data for the five selected locations is shown above in Table 3.2, while Figure 3.24 and Figure 3.25 are graphical representations of the data for rainfall and snowfall respectively.

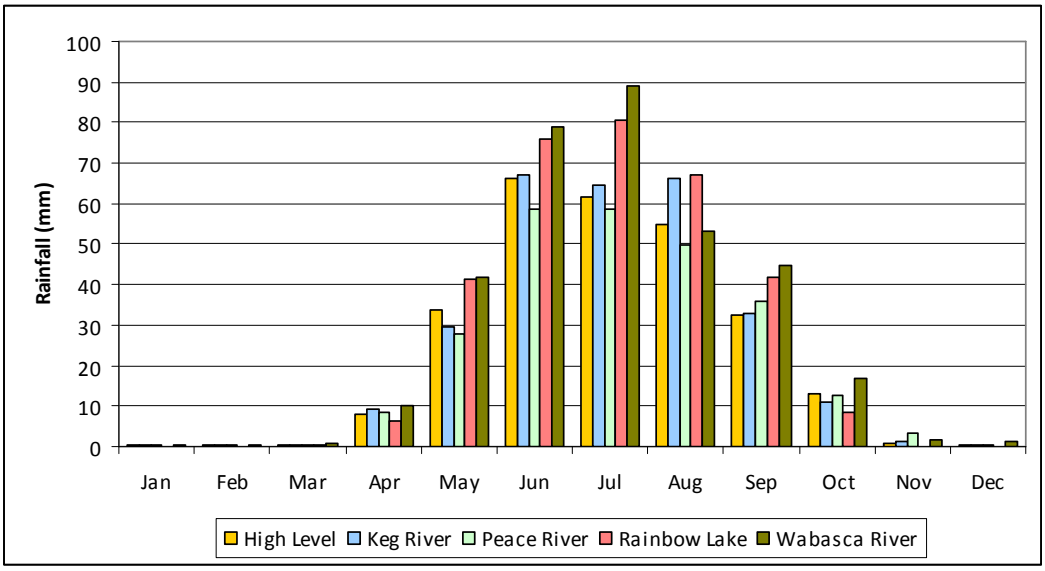


Figure 3.24 : Average monthly rainfall for selected locations

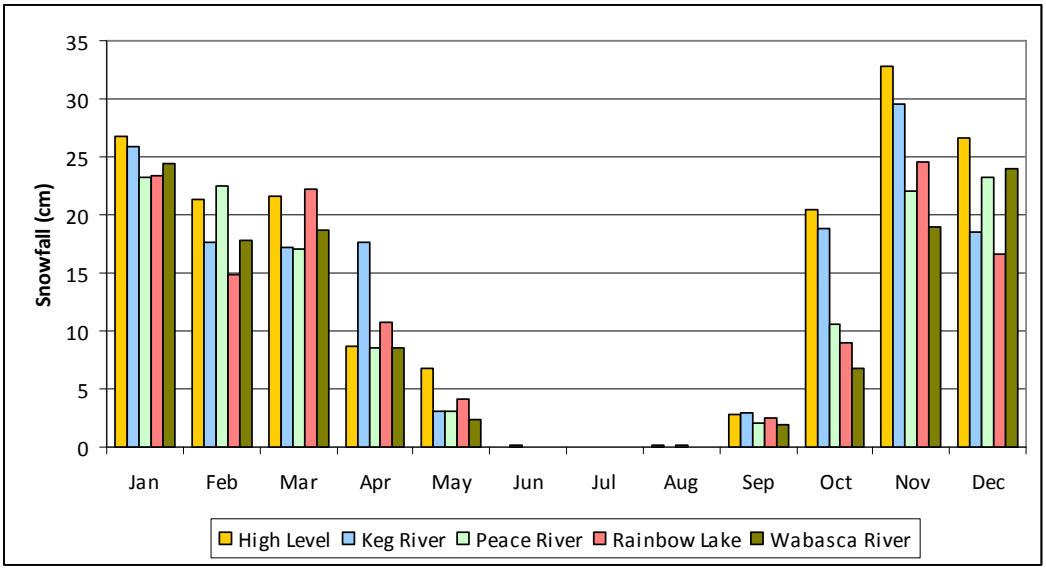


Figure 3.25 : Average monthly snowfall for selected locations

Average annual rainfall ranges from 257 mm at Peace River to 339 mm at Wabasca River. The majority of the rain falls during the summer months of June to August, with monthly precipitation amounts of 60 to 80 mm being common. Most of the rain falls over broad areas under the influence of upper level disturbances (cold lows); variations in rainfall between areas are usually the result of localized convective activity (showers or thundershowers).

Mean annual snowfall ranges from 128 cm at Rainbow Lake to 168 cm at High Level. Snowfalls of 20 to 30 cm per month are common from November to February. A broader range of years reveals some interesting records on average annual combined precipitation (494 mm Twin Lakes) and single day anomaly precipitation events; rainfall (146 mm, Watt Mountain Tower,1998 event), snowfall (55 cm, Doig Tower, May 1989).[19]

[19] Source: The Weather Network (http://www.theweathernetwork.com/statistics) –precipitation statistical records

4 Forest Landscape Pattern and Structure

Inventories of forest community structure in the region and on the DFA reveal landscape patterns in terms of vegetation species, covertype combination, age classes, seral stages, patch structure (size, shape, connectivity, association with physical landscape features) and variability over space and time. It is against these patterns that the forest manager evaluates a range of different harvest and regeneration strategies in the challenge to approximate natural landscape mosaics.

As part of the DFMP process, a determination of the area available for procuring wood fibre was completed for the two FMA areas. A process of removing non-forested and other lands deemed non-productive for timber supply or excluded from timber supply due to other value constraints, such as riparian buffers, protected areas, and special wildlife features associated with high-risk species ultimately provides this operable area. These lands are removed from the total landbase to provide a basis for calculating the level of timber harvest that the FMA area will be able to sustain over the long term. Table 4.1 provides a summary of the landbase areas for both FMAs (Note: the following tables summarize only "treed ha" of composite forest polygons, not total ha).

Table 4.1 : Net landbase area by FMA

	Eastside FMA		**Westside FMA**		**Total**	
	(Ha)	**%**	**(Ha)**	**%**	**(Ha)**	**%**
Gross Landbase	1,735,596	100%	959,566	100%	2,695,162	100%
less Deletions	858,925	49%	354,032	37%	1,212,957	45%
Net Landbase	**876,671**	**51%**	**605,534**	**63%**	**1,482,205**	**55%**

4.1 Forest Tree Species Composition and Cover Types

The DFA area is comprised of stands that are highly variable in cover type (density, canopy height, tree species). reflecting a blend of stochastic fire history characteristic of the region, natural succession. The boreal mixedwood forest mosaic found in the DMI FMAs contains several tree species including trembling aspen, balsam poplar, white birch, white spruce, lodgepole pine, jack pine, black spruce and tamarack. Of these species, trembling aspen is the most important to the hardwood pulp industry, and white spruce is the most important to the local softwood pulp and dimension lumber industry. Balsam poplar and pine are secondary species targeted for timber supply.

DMI designed protocols for calculating the broad cover group (BCG) of each stand in the FMAs based on the percentage of deciduous crown closure calculated from their AVI cover type. The broad cover groups are coniferous (C), coniferous/deciduous (CD), deciduous/coniferous (DC) and deciduous (D). As shown in Table 4.2, the Westside FMA has a higher proportion of conifer landbase, with over 50% of stands in the C or CD broad cover groups, while there is only 30% in the Eastside FMA.

Table 4.2 : Net landbase treed area by broad cover group by FMA and FMU

FMU	Broad Cover Group[a]										Total
	C		CD		D		DC		Unassigned		
FMA East											
F1	46,005	21%	9,985	5%	146,884	68%	11,107	5%	1,522	1%	215,503
P3	28,683	29%	5,387	5%	55,545	57%	7,336	7%	1,169	1%	98,120
P4	42,068	23%	8,269	4%	119,049	64%	13,878	7%	2,082	1%	185,346
P5	45,328	24%	8,207	4%	120,976	65%	10,195	5%	1,295	1%	186,001
S15	51,345	28%	9,607	5%	106,128	57%	15,465	8%	3,023	2%	185,569
Total	**213,429**	**25%**	**41,454**	**5%**	**548,583**	**63%**	**57,981**	**7%**	**9,091**	**1%**	**870,538**
FMA West											
P19n	52,003	34%	6,443	4%	84,431	55%	8,658	6%	801	1%	152,336
P19s	212,322	48%	34,074	8%	144,235	32%	47,215	11%	8,898	2%	446,745
Total	**264,325**	**44%**	**40,517**	**7%**	**228,666**	**38%**	**55,874**	**9%**	**9,699**	**2%**	**599,080**
Grand Total	**477,754**	**33%**	**81,971**	**6%**	**777,249**	**53%**	**113,855**	**8%**	**18,790**	**1%**	**1,469,618**

[a] Based on cover group assignment in composite landbase.

4.2 Forest Age-classes

A clear understanding of stand age is fundamental to forest planning and management, particularly with regard to modeling future wood supply but also in recognizing the physical structure within stands that evolves with age and provides for different species habitats. The current forest age-class distribution and amounts (hectares) in the DFA are presented in 10 year classes, based on stand age attributes (decade of origin) provided by AVI, for the productive forest landbase for each FMA (east, west) and each FMU. West-FMA age-class distributions will be illustrated specific to each former FMU (P13, P1N, P10, P11) rather than per the collective new P19 FMU since different coniferous timber allocations for embedded quota holders had influenced the landbase assignment of Broad Cover Groups.

The Eastside FMA distribution graphs are presented in Figure 4.1 to Figure 4.6. The age-class distribution within the Westside FMA is presented in Figure 4.7 to Figure 4.9. The 1999 *Biophysical* document referred to these representations as Stand Age Frequency graphs or FMU Age Class Composition.

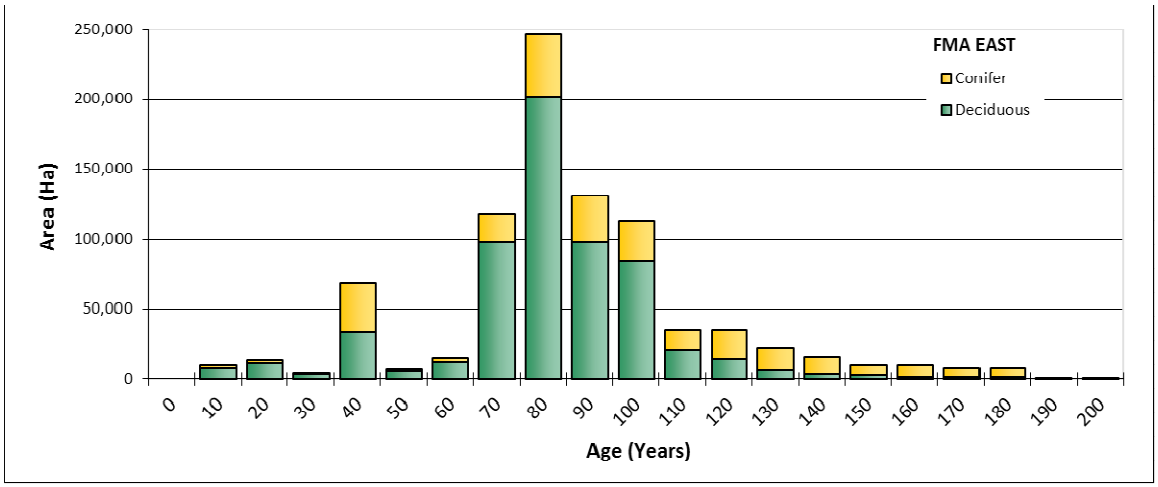


Figure 4.1 : Age-class distribution for the productive landbase – FMA EAST

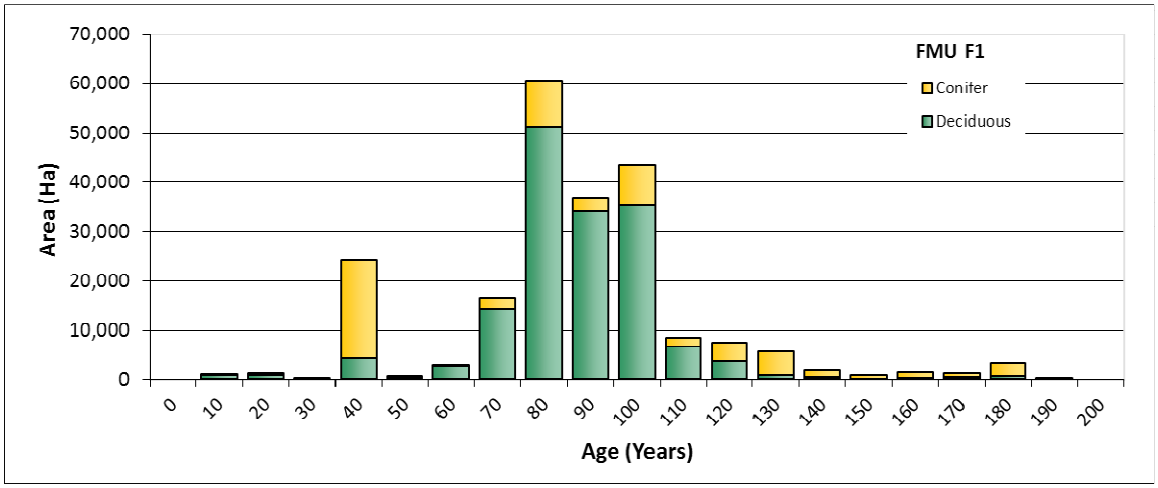


Figure 4.2 : Age-class distribution for the productive landbase – FMU F1

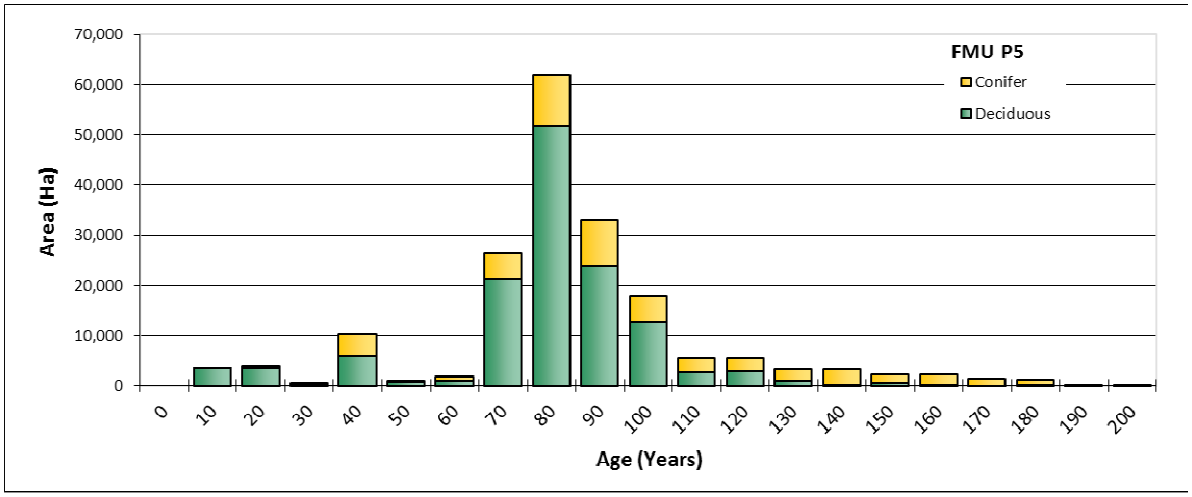


Figure 4.3 : Age-class distribution for the productive landbase – FMU P5

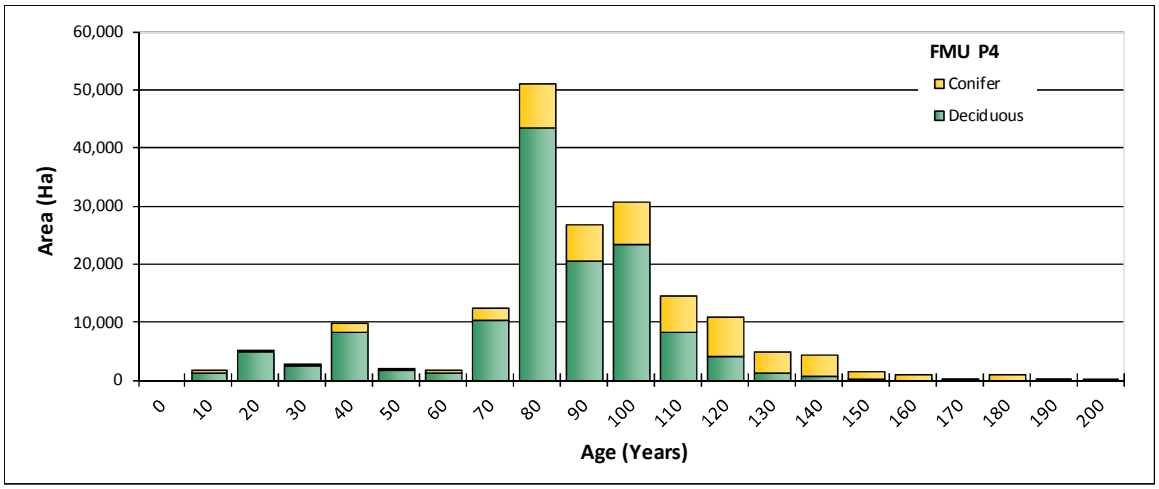


Figure 4.4 : Age-class distribution for the productive landbase – FMU P4

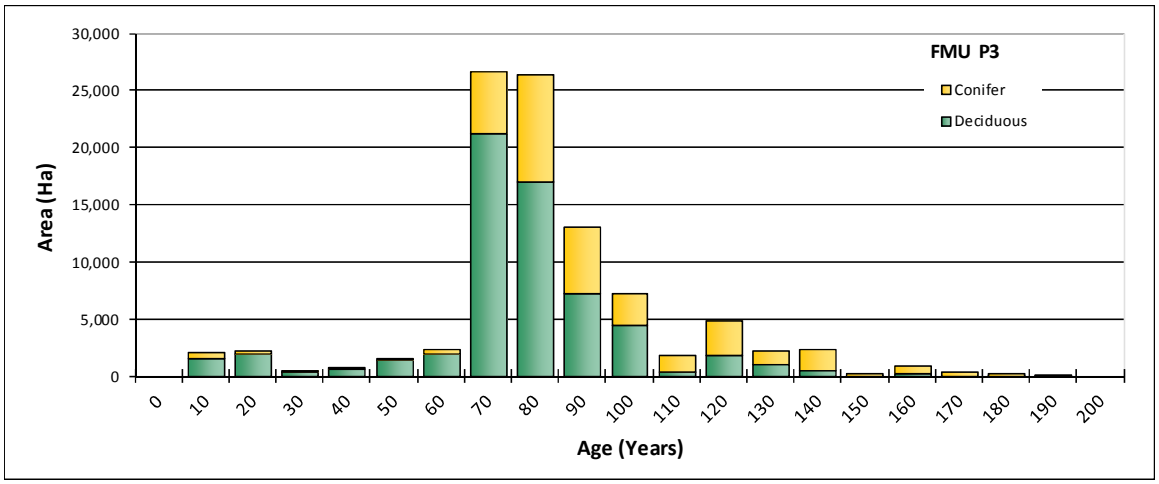


Figure 4.5 : Age-class distribution for the productive landbase – FMU P3

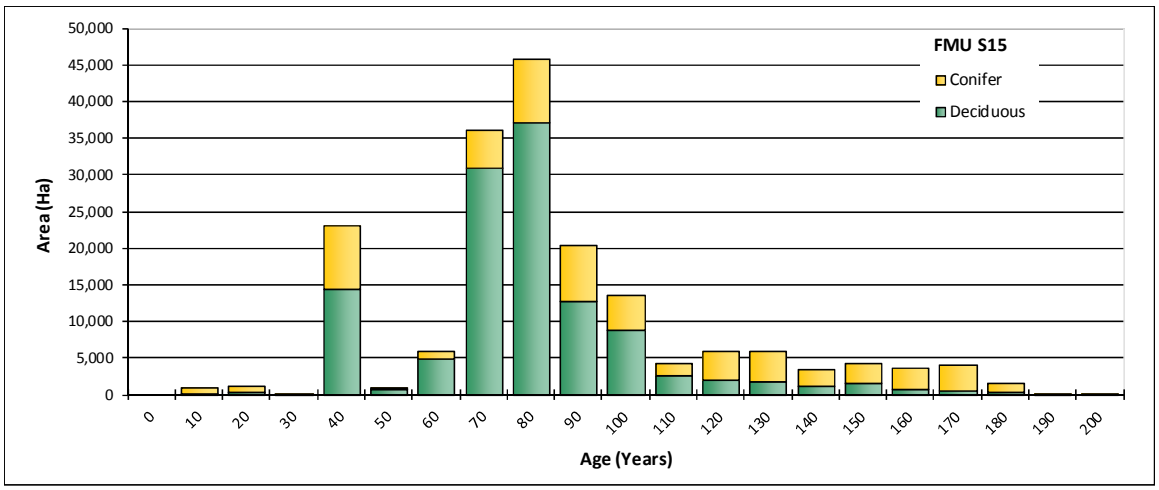


Figure 4.6 : Age-class distribution for the productive landbase – FMU S15

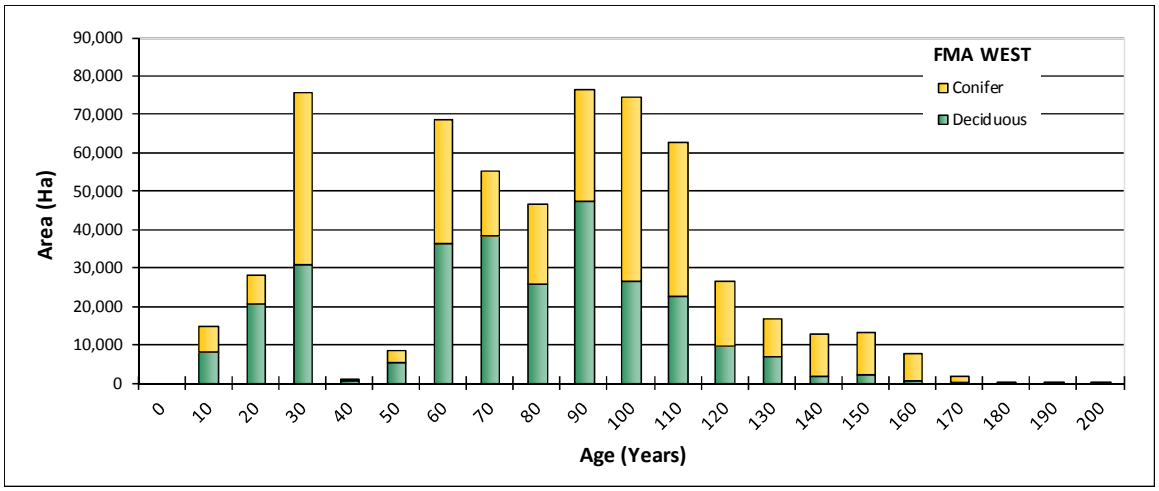


Figure 4.7 : Age-class distribution for the productive landbase – Westside FMA

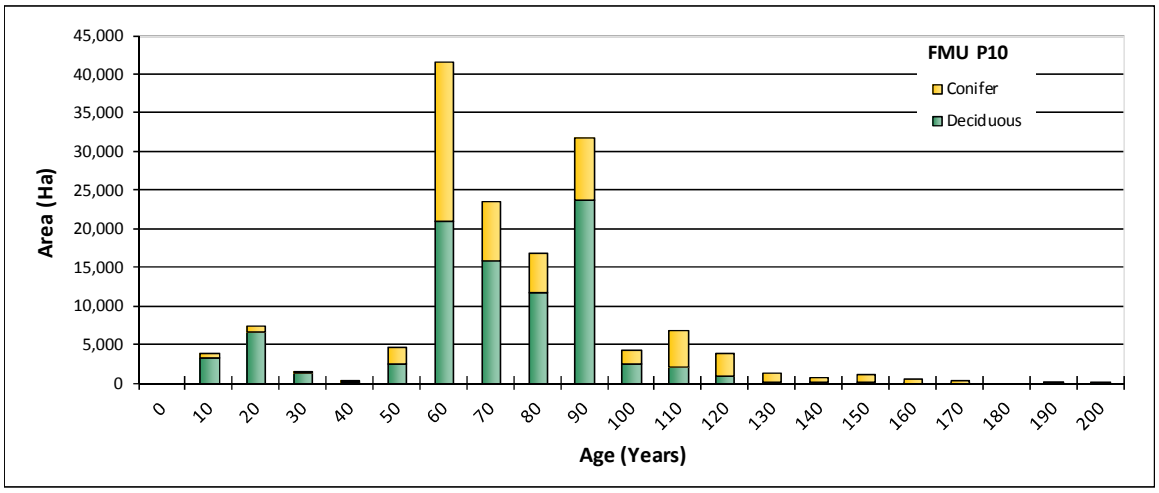


Figure 4.8 : Age-class distribution for the productive landbase – P19 (north)

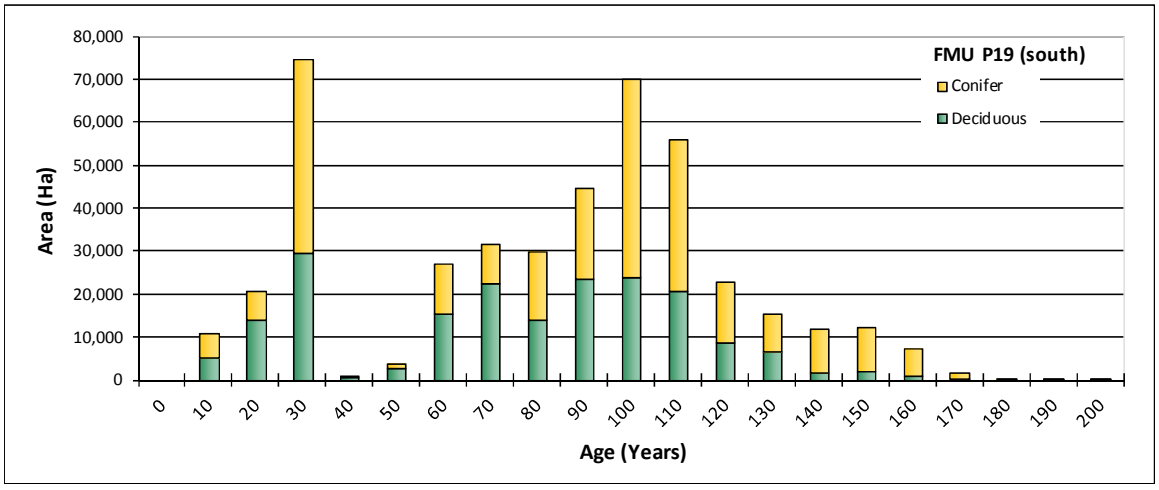


Figure 4.9 : Age-class distribution for the productive landbase – P19 (south)

Notably, S15 and F1 (Eastside FMA) are the only FMUs with any appreciable land area in forest stands 40 to 50 years of age. The Westside FMA is low in 40-60 year stands and the Eastside FMA is low in 50-70 year stands. The Eastside FMA has a distinctly low proportion of stands under 70-years age relative to the Westsed FMA reflecting the lower level of figures and harvesting activities. The distribution of other age-classes showing significant hectares however, is at least partly explained by the region's fire history that includes stochastic events of large wildfires or some years of multiple large area burns. (see Landscape Disturbance and Fire Regime Analysis sections) This is of course connected to the belief that periodic large fires create large patches of stands with generally similar age. Nevertheless, this highly varied distribution of age-classes on the DFA suggests that natural disturbance rates have not been constant during recent history (~100 years).

4.3 Seral Stages

A seral stage can be defined as any stage of development of a forest ecosystem from initiation to a mature climax plant community. The age-class distribution was used to categorize the productive forest into ecologically distinguishable seral stages whose characteristics (e.g. structural distinctions) are observable in the field. The breakdown of these categories is provided in Table 4.3, where deciduous refers to the D and DC cover types and coniferous is made up of the C and CD cover types.

Table 4.3 : Seral stage classification by cover type

Seral Stage	Deciduous Age-classes	Coniferous Age-classes
Stem initiation	10	10, 20
Stem exclusion	20, 30	30, 40, 50
Immature	40, 50, 60, 70	60, 70, 80
Mature	80, 90	90, 100, 110, 120
Breakup	100 and older	130 and older

Figure 4.10 to Figure 4.13 present the seral stage distributions for the Eastside FMA by FMU, and by coniferous:deciduous totals per FMA.

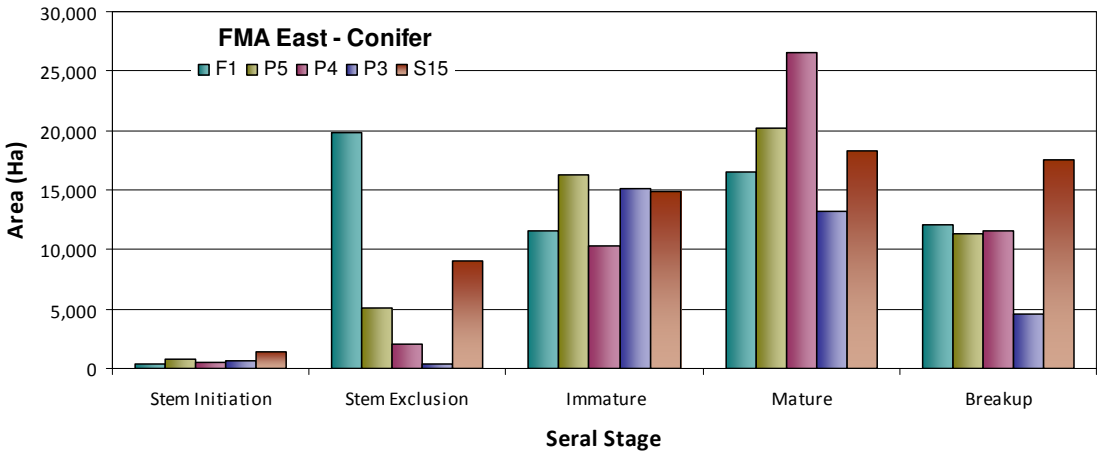


Figure 4.10 : Conifer seral stage distribution by FMU on Eastside FMA

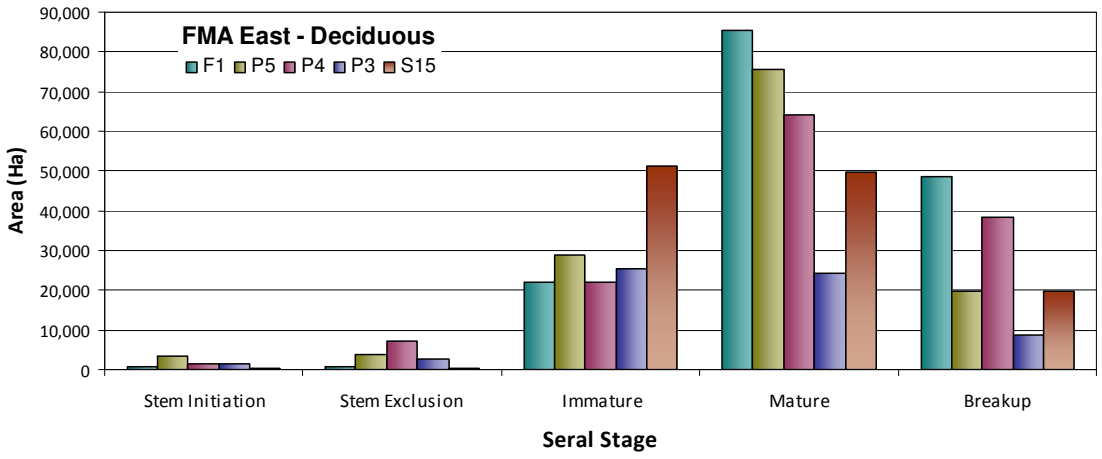


Figure 4.11 : Deciduous seral stage distribution by FMU on Eastside FMA

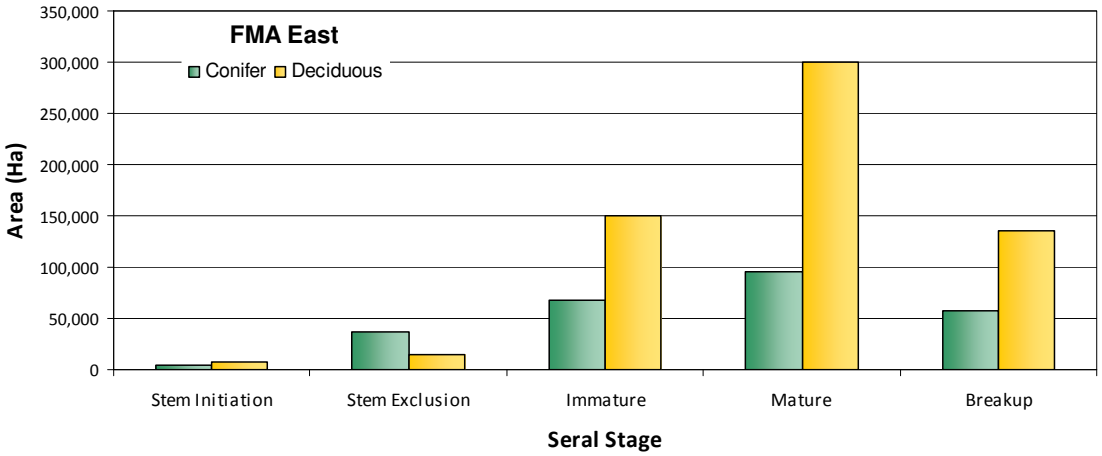


Figure 4.12 : Seral stage distribution on the Eastside FMA.

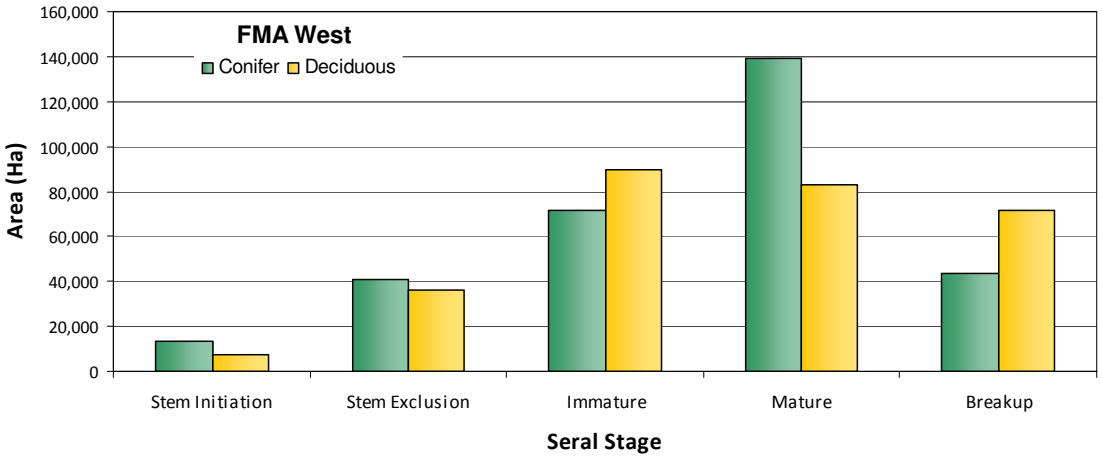


Figure 4.13 : Seral stage distribution on the Westside FMA

4.4 Forest Patches

Discussion of forest patches includes such metrics as polygon (or stand) size, shape, perimeter edge, connectivity, and association with specific physical landscape features. Data for this section is to be provided eventually by Alberta (Sustainable Resource Development) as a component of a biodiversity habitat description assessment associated with a 2010 Alberta directive on forest tenure roles and responsibilities (February 2010, Appendix 2 –Inventory and Monitoring).

The 1999 *Biophysical* report documented a frequency pattern for total area within each of a number of forest size class polygons (10 ha intervals to 700+ hectares) finding it generally similar for each of the natural subregions within the FMA of the time. Stelfox's opinion was that the data did not provide any clear statistical evidence to support moving forest management strategies toward a concept of constructing different patch size distribution for different natural subregions in northwest Alberta. He also suggested that since FMU's are a geo-administrative unit having no ecological basis, there appeared to be no reason to evaluate stand size distributions based on this geo-administrative landscape classification. Consequently, the Stelfox landscape analyses assisted largely in clarifying the range of forest stand sizes that exist within the region, but also that such a metric is logically best managed at the landscape scale.

What Stelfox observed in the forest inventory data pre-1999 was that cutblock sizes of the former 2-pass harvest regime contributed to a landscape moving toward a smaller range of variability than that observed in the natural pyrogenic (fire origin) landscape. This essentially offered part of the justification for an alternative forest strategy that would leave residual "green tree" patches inside harvest blocks (e.g. create small stands), and also expand the permissible size of harvest blocks (e.g. create large stands) to collectively provide for closer replication of a patch-size range that occurs through natural disturbance drivers.

4.5 Spatial and Temporal Variability of Cover Types and Seral Stages

The highly varied distribution of DFA age-classes and seral stages demonstrated in previous sections suggests that natural disturbance rates are highly variable in recent history (~100 years). Forest areas that contain older seral stage forests (greater than 120 years) may reflect local or regional meteorological and topographic conditions that are less conducive to wildfire, or may simply reflect areas that have randomly escaped fire in recent decades. Periodic large-area blowdown events have also been observed within the region in the past two decades (e.g. Bat Lake, S10 FMU), so may in part also contribute to some of the spatial variability in seral stages that occurs through another form of stand-replacing natural disturbance.

Forest cover types have been shown to be cariable as a function of a site's drainage. Pine, with its life history suited to better drained sites, are proportionally most common in what today are defined as the Lower Boreal Highlands and Dry Mixedwood subregions. Black spruce is most common in the Central and Dry Mixedwood subregions. Birch while not a dominant species in any subregion, exhibits its highest presence in what today is classified as the Upper Boreal Highlands.

One particular temporal pattern emerged in the 1999 analyses concerning a very important inter-relationship between aspen and coniferous species in the region. Stelfox noted that aspen canopy cover increases during the initial decade following wildfire disturbance, remains present during the first 40-years and then often begins a general decline coinciding with the emergence of softwood species in the canopy. This phenomenon sees the gradual conversion of hardwood-dominant stands to mixedwood stands, and subsequently the transition of mixedwood stands to softwood-dominant stands where composition is primarily or exclusively conifer. Over long timeframes, deciduous tree species (aspen, poplar, birch) in the region tend to decline in canopy cover as forest succession occurs, and softwood species generally increase to take their place. A sample of temporal variability in cover type that occurs as a product of forest succession dynamics within the mixedwood boreal forestsas is shown in Figure 4.14. Other aspects of temporal variability in cover type factors (e.g. density) are illustrated in that 1999 document.

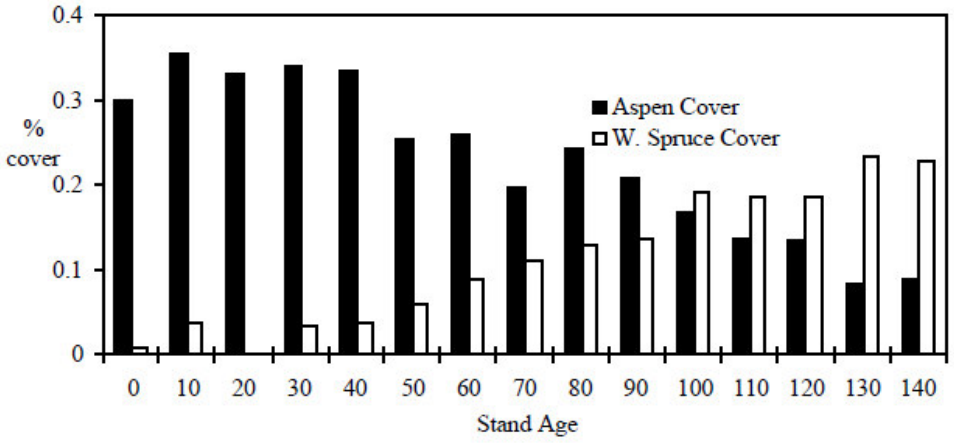


Figure 4.14 : Deciduous – Coniferous Succession within the Boreal Forest

Source : Biophysical document, p4-98

4.6 Horizontal and Vertical Forest Stand Structure

Increasingly the discussion of horizontal and vertical physical characteristics of forest stands is important to management strategies that purport to emulate certain aspects of natural disturbance and maintain activities within the natural range of variation (NRV) in the interests of ecosystem health and biodiversity conservation. In this context forest structure refers to components of the natural forest that include green trees, dead standing snags, downed wood debris (DWD), coarse woody debris (CWD) as a distinct size of dead wood, litter-layer (organics) and understory plant communities at a range of spatial scales.

Baseline qualitative and quantitative data on such forest structure features as deadwood (horizontal), snags (vertical), understory plant communities and organic soil components while important, today remain somewhat elusive considering the scale of landscape managed and the diversity within it. Traditional remote sensing used to capture forest inventory data is simply unable to detect the level of detail associated with structure.

Two key elements of forest structure are DWD and retention. Large diameter DWD (26–35+ cm) appears to be persistent on the forest floor and at no time in the successional pathway is it absent. This larger material increases in its density of occurrence slowly during the initial 40 years after a wildfire event, reflecting the fall-down (recruitment) of pre-disturbance green trees and snags. Boreal wildfires almost always see some hardwood and softwood trees surviving the fire event. These were some important guiding principles in the consideration of variable-retention harvest design objectives and practices.

5 Forest Landscape Disturbance and Succession

Forest landscape disturbances and succession of the forest as it ages over time have shaped the forests that we are enjoying today. To capture the variety of factors affecting the growth and composition of the forest, reviews on the inherent disturbance regime, insects and diseases, forest succession, timber harvesting, forest industry access, industrial access and development, and monitoring sites are presented.

5.1 Inherent Disturbance Regime

Northwest Alberta's natural disturbance regime is characterized by a combination of disturbance types that occur at a variety of spatial and temporal scales, including wildfire, pathogens (insects, disease), beaver activity and small-scale slide events along incised valleys. These agents are largely omnipresent and have influence at both landscape and stand scales. The region has experienced rare stochastic events of extreme wind damage that impacted both conifer and deciduous forests. Major flood events associated with the Peace River and other smaller rivers occur but also tend to be rare. Their impact to forest stands at a landscape scale is arguably small relative to the more consistent small-scale but widespread influence of beavers (localized flooding) and natural slump events that are common to the region.

Fires caused by lightning and humans are common events in northwest Alberta. Although small fires dominate in frequency, episodic large fires (>1000 ha) account for over 95% of area burned between 1961 and 1995. Fire prevalence and area burned is most pronounced in mid-summer (July), but this pattern is affected by forest canopy composition. Spruce, mixedwood, and pine communities experience peak fire frequency in July, while parkland (grassland) and deciduous communities peak during May. The region is not characterized by a single fire regime; rather, some geographic distinctions in landform and climate appear to affect fire behaviour by altering forest structure and fire weather characteristics. Stelfox conducted a coarse analysis of local regime distinctions and noted that fire occurrence is highest in the Upper Boreal Highlands Natural Subregion and lowest in the Dry Mixedwood Natural Subregion. Since the time of the initial 1999 *Biophysical* assessment a new provincial project occurring under the Natural Disturbance Program (Foothills Research Institute, Dr. David Andison) has been striving to clarify finer-tuned geographic-based regimes using a variety of metrics obtained from historical (pre-industrial) wildfire patterns (circa 2007-2010).

The 2010 Stelfox cumulative effects assessment comparing industrial disturbance footprints to the influence of the wildfire regime noted that in terms of timber-supply security, the greatest threat to continuity of current annual allowable cut remains the fire regime inherent on this northern landscape. This attests to the dominance of wildfire among inherent natural disturbance sources in the region.

Quantitative and qualitative aspects of local fire regimes are discussed in further detail within section 6.2.

5.2 Insects and Diseases

5.2.1 Insects

Until recent history, three major pests had dominated insect disturbances in the region; spruce budworm, forest tent caterpillar and aspen tortrix. In general, these infestation sources tend to be cyclical in nature, epidemics occurring at somewhat irregular intervals and often persisting over consecutive years. Currently a mountain pine beetle (MPB) infestation, which has spread into the region from pine dominant regions to the west, poses a new significant threat to pine trees within the FMA's and the region in general.

5.2.1.1 Mountain Pine Beetle

The mountain pine beetle is a small bark beetle which attacks the vascular system (phloem) of primarily mature Lodgepole and Limber Pine trees. The beetle is native to Lodgepole Pine forests in the more temperate western North America. The eastern edge of the beetle's distribution lies along the Rockies along the Alberta – British Columbia border. Consequently, Alberta's pine forests have evolved largely in the absence of MPB. However, altered fire regimes through decades of successful fire suppression efforts, have resulted in more mature and old-growth forests on the landscape than might normally occur naturally. Coupled with a changing climate, such influences have increased the over-winter survival of larvae and the availability of a landscape of older seral stage pine stands to give rise to optimal conditions for MPB infestations in areas considered outside their normal distribution.

MPB has devastated the mature large-diameter Lodgepole Pine stands in interior British Columbia in recent years and is currently killing large areas of pine forest in southwestern Alberta near the slopes of the Rocky Mountains. Infestations spread during 2009 into the Grande Prairie area as well as forests immediately south and north of the Peace River. Currently the confirmed local forests with MPB impacts are located east of Peace River in the vicinity of FMU P3, as well as in the Westside FMA (especially P19 south). Figure 5.1 illustrates the 2009 northerly and easterly distribution extent of infestation (Alberta government).

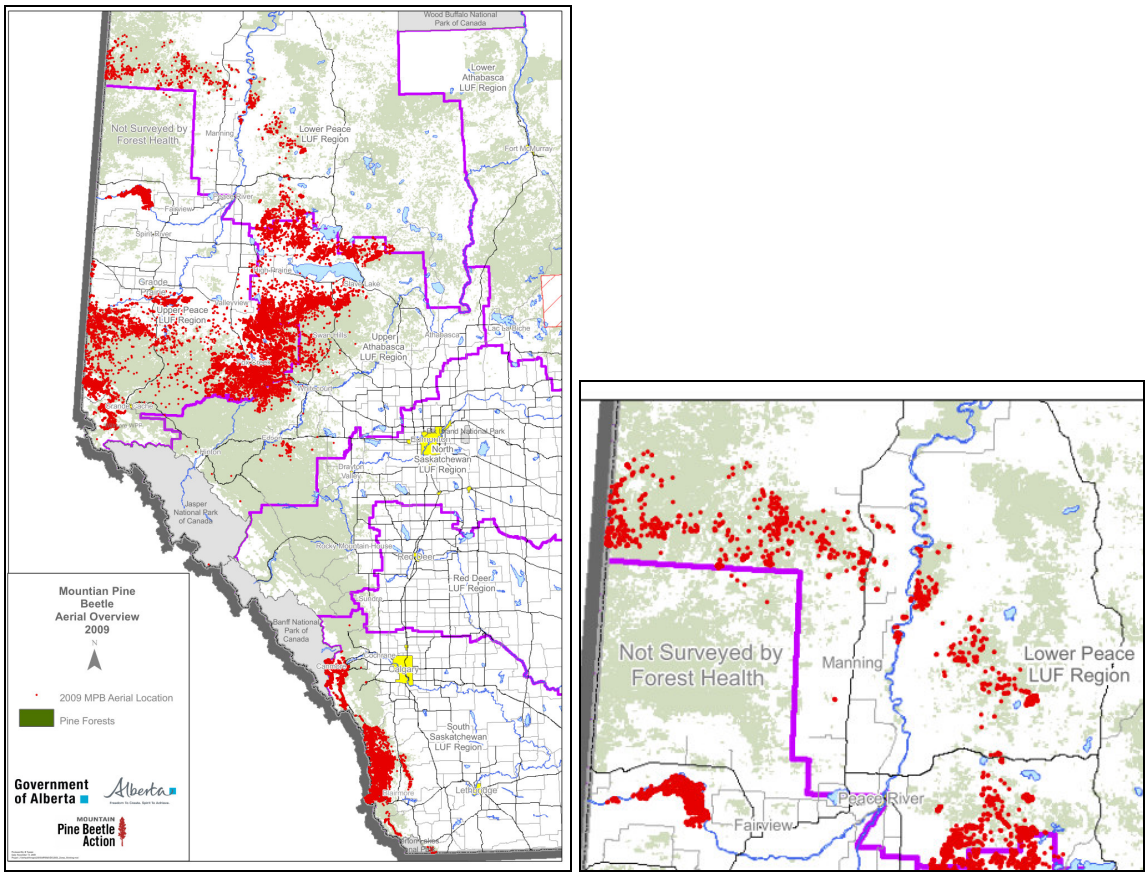


Figure 5.1 : Mountain Pine Beetle –Aerial Locations (2009)

By 2010 the DMI FMA's lay within what Alberta considered an "inactive" infestation zone. The 2010 "leading edge zone" lies in an arc extending from the foothills south of Grande Prairie to south and east of Slave Lake. Northeastern Alberta is an area of focus[20] for Provincial Forest Health officials in an attempt to prevent the spread of MPB into the hybrid Lodgepole-Jack Pine complex and pure Jack Pine stands. Figure 5.2 illustrates the 2010 aerial survey locations and distribution of infestation extent in the Peace and Slave Lake regions. Figure 5.3 illustrates the 2010 Mountain Pine Beetle control zones which were mapsets developed by the Province as part of a public reporting strategy.

At the time of writing this Landscape Assessment, this particular conifer infestation was yet exhibiting very dynamic character with significant changes in distribution and annual status region-to-region. Alberta works very closely with industry forest managers in defining the status ratings criteria and guiding assessments for MPB susceptibility, as well as prioritizing the responses in infestation control and spread prevention tactics.

[20] Alberta government. 2010., http://www.mpb.alberta.ca , http://www.srd.alberta.ca/ManagingPrograms/ForestPests/MountainPineBeetle.aspx

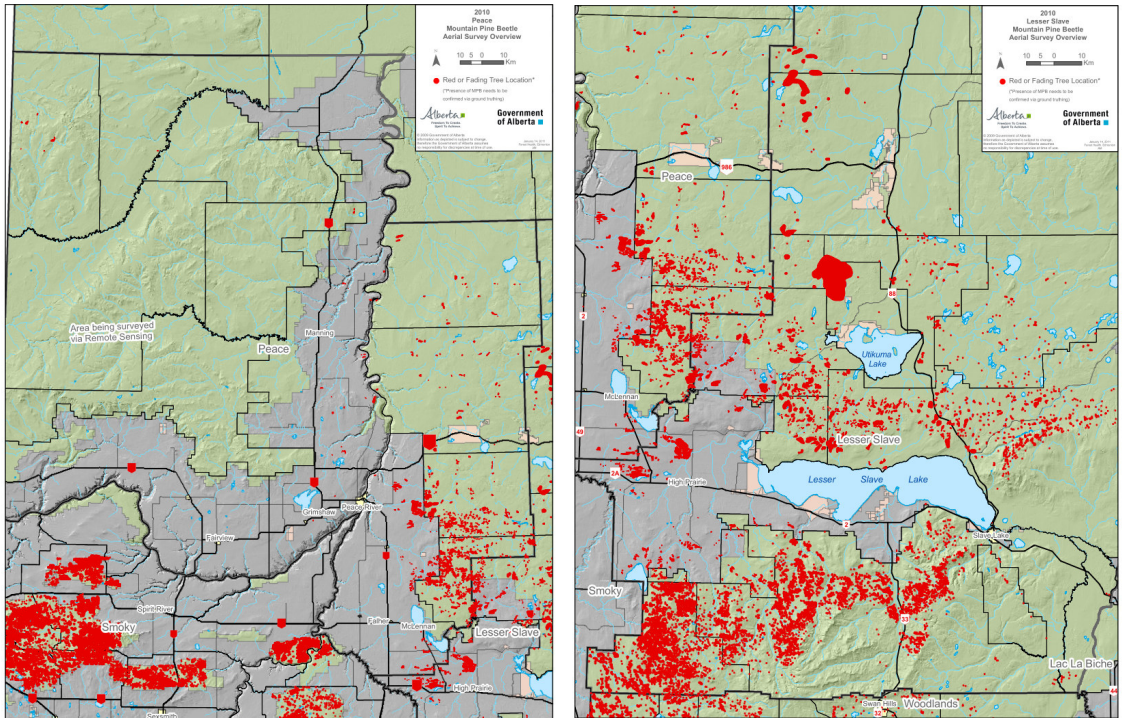


Figure 5.2 : Red or Fading Tree Locations (2010 Peace + Slave Lake)

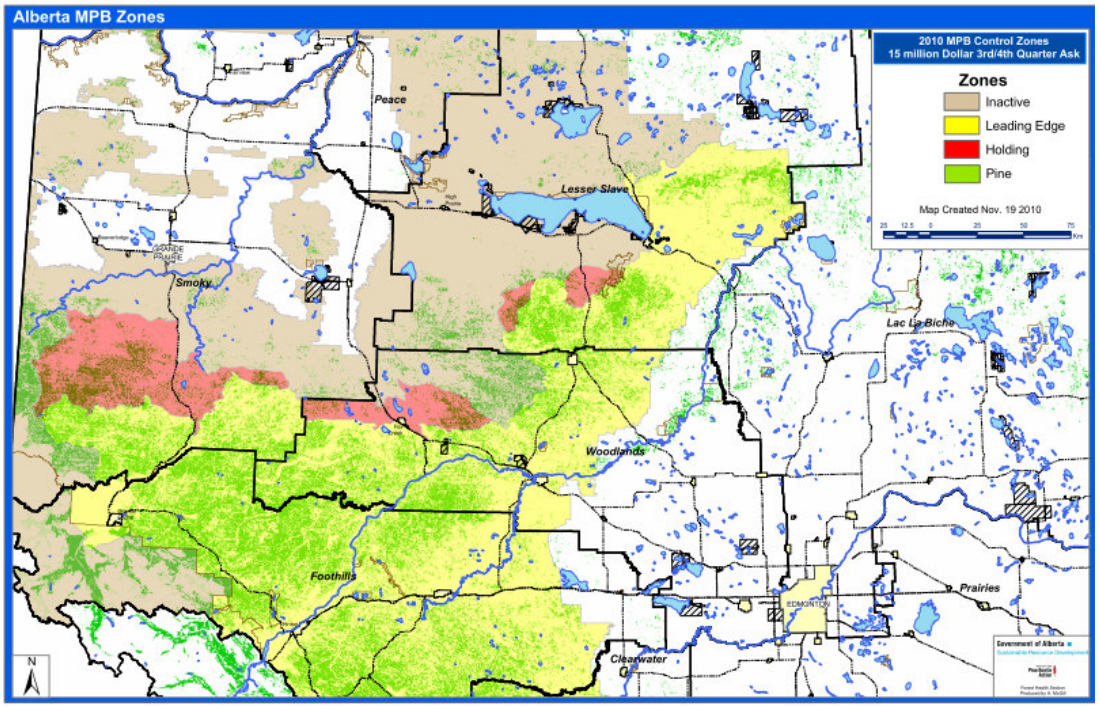
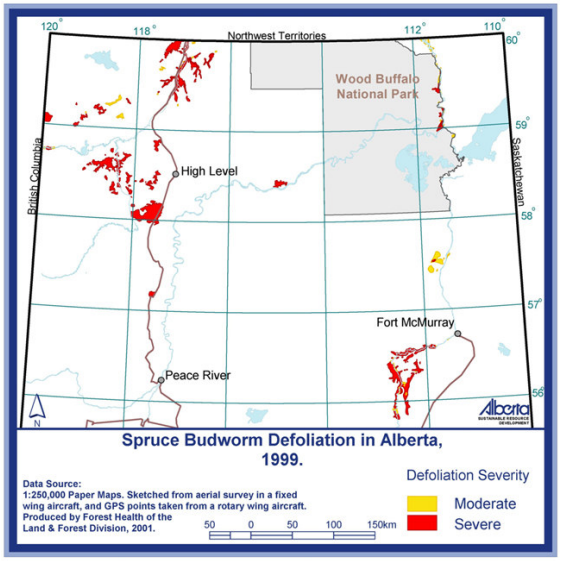


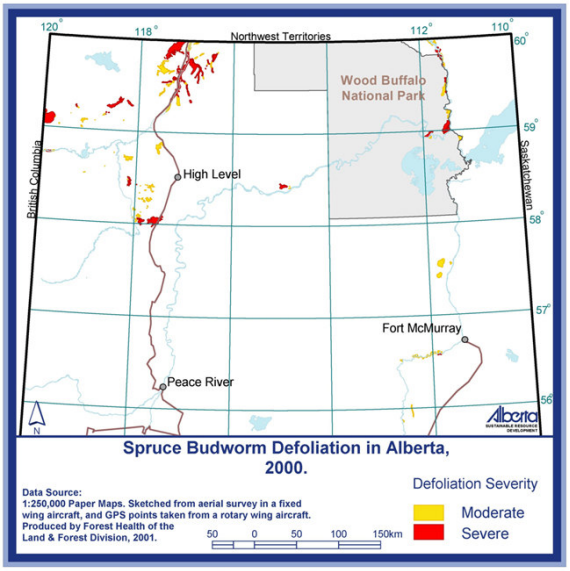
Figure 5.3 : 2010 Mountain Pine Beetle Control Zones

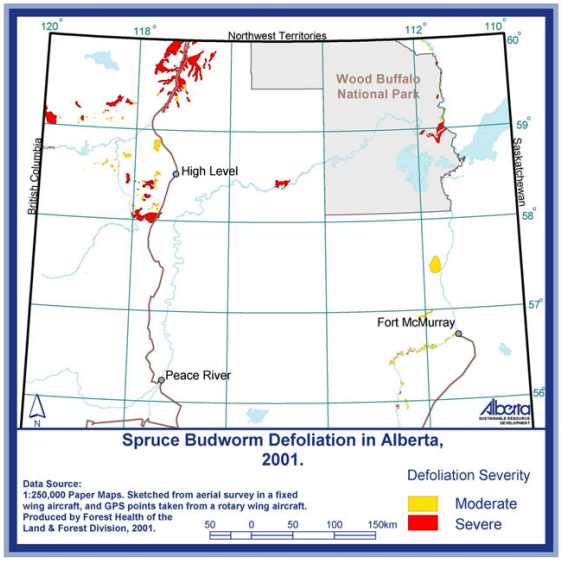
5.2.1.2 Spruce Budworm

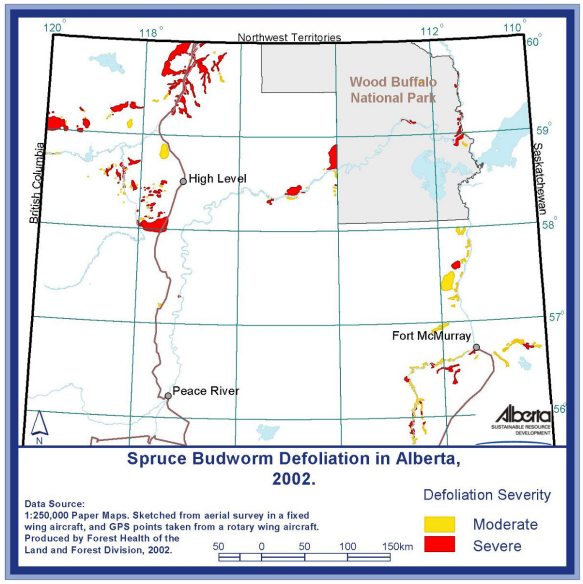
Until the arrival of MPB, the most significant historical softwood pest in the region has been the Spruce Budworm (*Choristoneura fumiferana* [Clem.]). The principle hosts of this pest are White Spruce and Balsam Fir, although it will also feed on Tamarack (Larch) and Black Spruce. The larvae of Spruce Budworm are voracious feeders often completely defoliating the current year's foliage. Consecutive years of defoliation lead to growth reduction, loss of flower production, top-kill and eventual tree mortality. A typical infestation, as exemplified by the infestation near the Chinchaga River (1999-2003) and areas west and north of High Level in the past decade can encompass large areas and cause significant damage. Current infestation challenges have been dominantly in northeast Alberta.

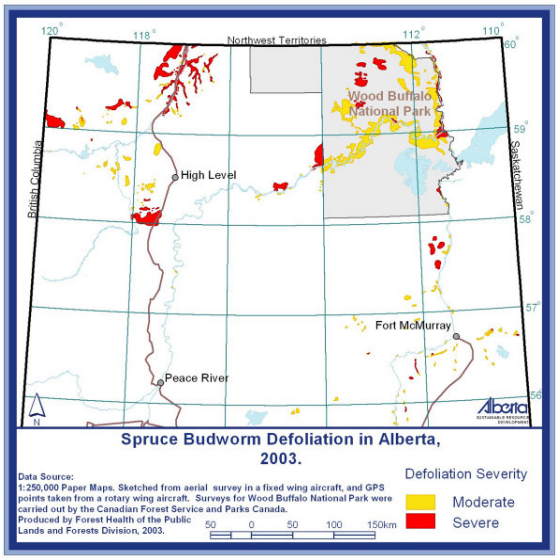
The following figures illustrate the cumulative landscape extent, distribution and relative severity of these defoliator infestations as reported by Alberta during the past 11-years.

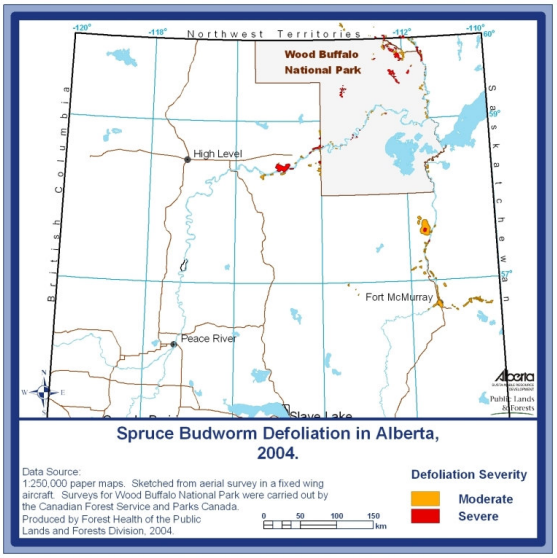


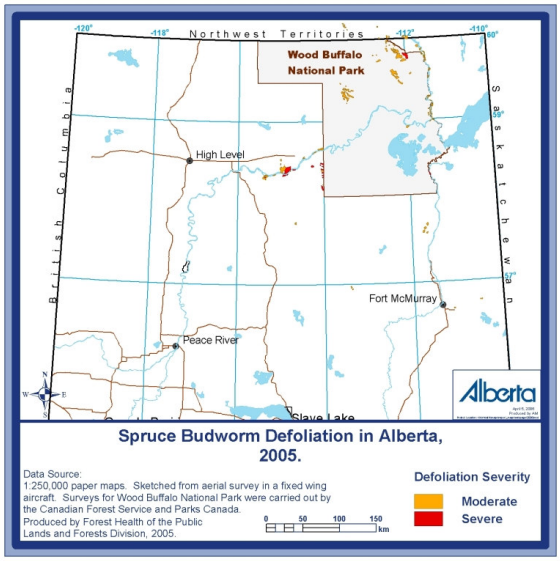


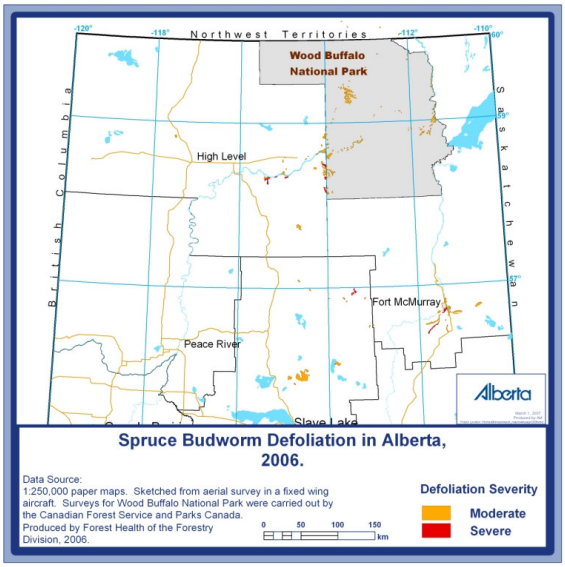


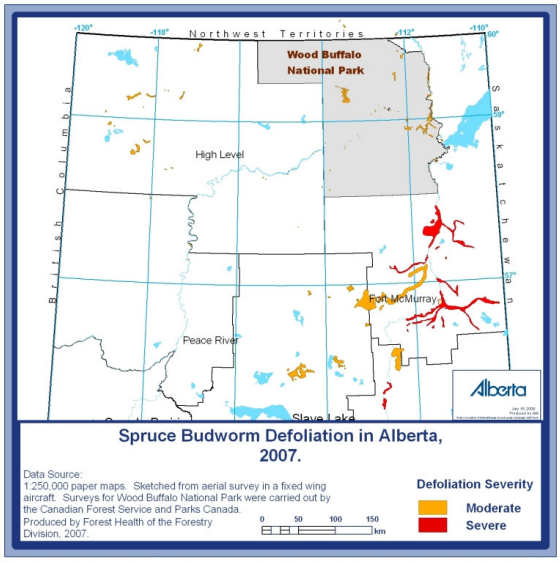


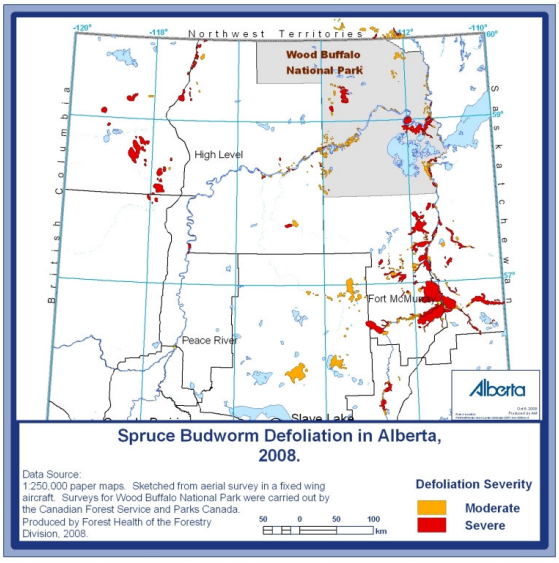

Northwest Territories
Wood Buffalo National Park
High Level
Fort McMurray
Peace River
British Columbia
Saskatchewan
Alberta
Spruce Budworm Defoliation in Alberta, 2003.
Data Source:
1:250,000 Paper Maps. Sketched from aerial survey in a fixed wing aircraft, and GPS points taken from a rotary wing aircraft. Surveys for Wood Buffalo National Park were carried out by the Canadian Forest Service and Parks Canada.
Produced by Forest Health of the Public Lands and Forests Division, 2003.
Defoliation Severity
Moderate
Severe


Northwest Territories
Wood Buffalo National Park
High Level
Fort McMurray
Peace River
Slave Lake
Alberta
Spruce Budworm Defoliation in Alberta, 2004.
Data Source:
1:250,000 paper maps. Sketched from aerial survey in a fixed wing aircraft. Surveys for Wood Buffalo National Park were carried out by the Canadian Forest Service and Parks Canada.
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Produced by Forest Health of the Forestry Division, 2007.
Defoliation Severity
Moderate
Severe


Northwest Territories
Wood Buffalo National Park
High Level
Fort McMurray
Peace River
Slave Lake
Alberta
Spruce Budworm Defoliation in Alberta, 2008.
Data Source:
1:250,000 paper maps. Sketched from aerial survey in a fixed wing aircraft. Surveys for Wood Buffalo National Park were carried out by the Canadian Forest Service and Parks Canada.
Produced by Forest Health of the Forestry Division, 2008.
Defoliation Severity
Moderate
Severe

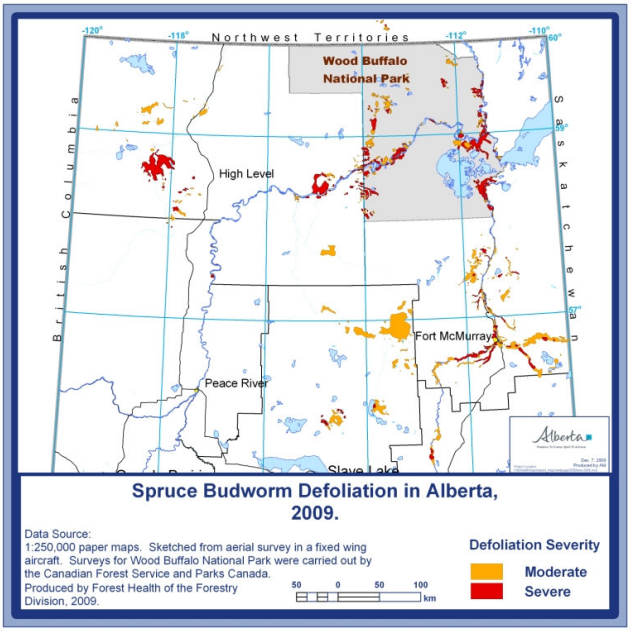


Figure 5.4 : Spruce Budworm Infestations Northern Alberta (1999-2009)

5.2.1.3 Deciduous Defoliators

The two dominant deciduous defoliators in northwest Alberta are the Forest Tent Caterpillar and Aspen Tortrix. Other lesser but persistently present deciduous defoliators include; Aspen Leaf Roller, Spearmarked Black Moth (birch defoliator), Aspen Serpentine Leaf-miner, Willow Leafminer. The most significant hardwood pest is the Forest Tent Caterpillar (*Malacosoma disstria Hubner*). Its principle host is Trembling Aspen, although other hardwoods species may be attacked once the principle host has been defoliated. Although defoliation through this caterpillar may be complete, mortality is not common because affected aspen usually produce a second flush of foliage. Damage is generally limited to growth reduction, although Canadian Forest Service literature routinely points to the significant cumulative volume losses that incur through FTC infestation cycles. Nonetheless, control strategies are largely non-existent and the landscape scale nature of these infestations would likely render such controls cost prohibitive under present market economies.

Another notable hardwood pest is the Large Aspen Tortrix (*Choristoneura conflictana* [Wlk.]). The preferred host of the LAT is Trembling Aspen although other deciduous trees such as Balsam Poplar and White Birch may also be affected. The damage inflicted by this insect is similar to that of Forest Tent Caterpillar although the severity and extent is typically less than that experienced with FTC. Rates of growth loss and mortality are likewise less than that attributed to the FTC.

The following figures illustrate the cumulative landscape extent, distribution and relative severity of deciduous defoliator infestation cycles as reported by Alberta during the past decade. The cyclic nature of these infestations is demonstrated in the sequential slides from 11-years (1999 – 2009).

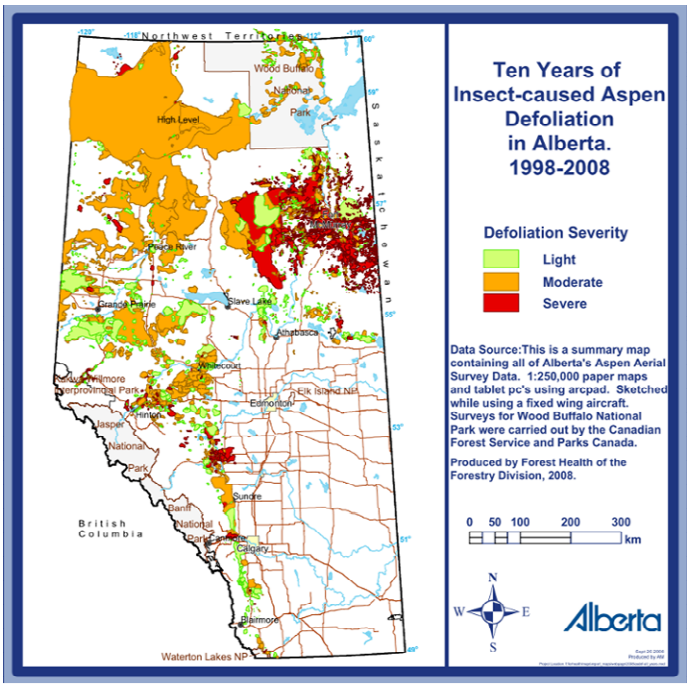


Figure 5.5 : Deciduous Defoliator Infestations –cumulative (1998-2008)

5.2.2 Diseases

Diseases that impact forests in this region include Hypoxylon Canker (*Hypoxylon mammatum* (Wahl.) J.H. Miller), root rot fungus species such as Armillaria Root Rot (*Armillaria spp.*), and decay-inducing fungi such as *Phelinus tremulae* (Bond & Boriss) and *Peniophora polygonia* (Pres.:Fr.). Although the impact of diseases is comparable to that of insect pests, accurate estimates of mortality and growth loss are challenging because of detection issues. This is due, in part, to the complexity of measuring decay losses, the landscape sizes within which they occur and to the often ubiquitous nature of these pathogens. Similar to the impacts of defoliator species, Canadian Forest Service scientists point to the significant cumulative volume losses that incur through such pathogens. Yet, control strategies are largely non-existent, or not commonly in application. The landscape scale nature of these pathogens and the issues in detection at such scales would likely render such controls cost prohibitive under present market economies.

5.3 Invasive Exotic Species

Currently no invasive exotic invertebrate species are known to reside in this region. To date the gypsy moth, *Lymantria dispar* (L.) has proven not to become established in the region or anywhere in Alberta beyond sporadic observations, yet it is one of the most serious introduced pests of trees in eastern Canada. It prefers to feed on the foliage of oak trees, which are not native to Alberta's forest. However, it can attack and kill other deciduous and conifer tree species and as such remains a potentially serious threat to Alberta's forests.

Among plant kingdoms a variety of invasive species have grown to become areas of risk within native forest ecosystems of northwest Alberta. Some of these have become introduced through former reclamation policies and recommended plant species included in "forestry mix" guidelines prior to the 1990's (e.g. Alsike Clover). With the onset of new provincial guidelines, the use of former agriculture-centric species have been replaced by native-species seed requirements, seed certification of purchased stocks and revisions to the general approach to reclamation that focus on facilitating seed-use with other techniques that encourage ingress from native top-soil seedbed.

Other invasive and noxious weeds have also been introduced gradually through the past 4-5 decades of increasing land-use activities, access development and recreational traffic on that access that collectively serve to assist migration of seed from agriculture zones both locally and from central to southern Alberta. Movement of heavy equipment and pipeline materials from storage areas in agricultural areas or urban areas has proven to be a source-point for species such as Scentless Chamomile and Canada Thistle among a variety of other species. Problematic invasive species have tremendously effective seed-dispersal mechanisms, abundant seed production characteristics, capacity for lengthy seed dormancy, and in some cases propagate readily through the root system. Consequently, the past decade has seen tremendous regulatory and education initiatives directed at prevention strategies, monitoring and weed control planning requirements on all industries operating on public forests.

5.4 Forest Succession Trajectories

Forest succession and age-class trajectories for the two FMA areas are described in detail within the Preferred Forest Management Scenario within the DFMPs for each FMA. Those documents address the existing forest and targeted state for cover type composition and age class. Age class distribution is a key element that would have to be controlled in the future in order to provide for biodiversity and "wildness". Much of this draws from the 1999 *Biophysical* assessment and a multi-disciplinary Forestry / Wildlife Technical Committee (FWITC) that collaborated in designing a target age class structure based roughly upon the classic "inverse J" distribution of a theoretical fire-driven natural forest. This structure is shown in Figure 5.6. At that time the Management Team modified this input to more closely resemble the "inverse J" distribution by fitting an exponential trend line to the FWITC data. A ratio-reduction was applied to the derived J-curve values to ensure the area in each age class summed to 100%. This adjusted J-curve function was then used to generate modified area targets for each respective age class. The derived "inverse J" function was applied to the successional and empirical net landbases to calculate the area targets for each age class, landbase and sustained yield unit.

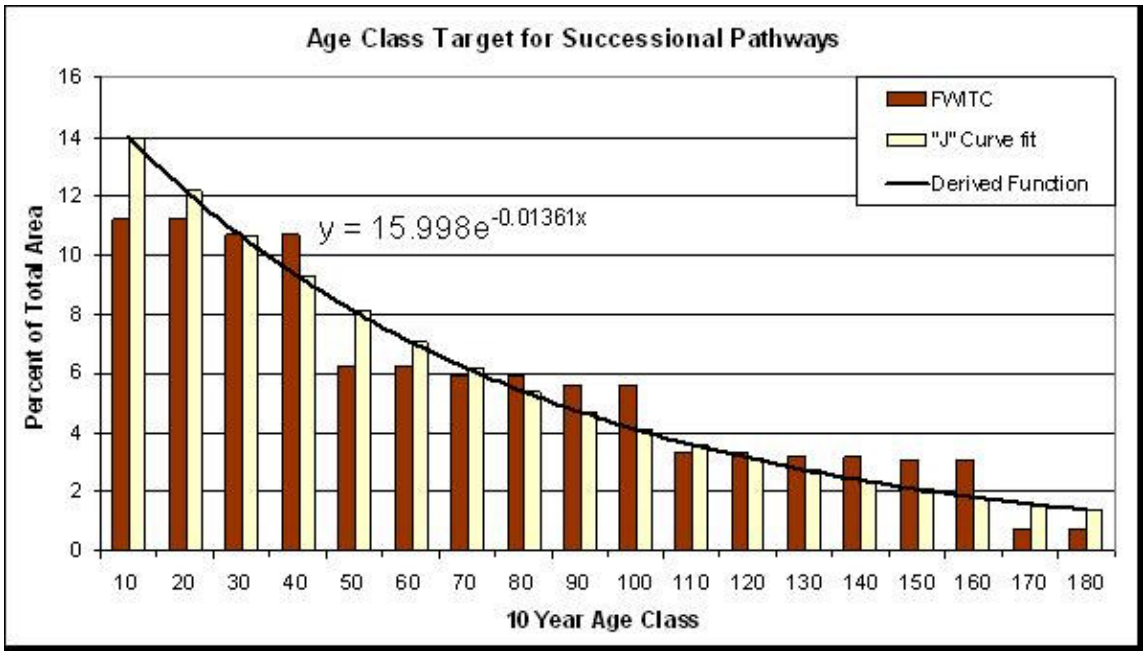


Figure 5.6 : Forest Succession –Age Class Trajectory (circa 1999)

Stelfox 2010 analyses in his Northwest Alberta Cumulative Effects ALCES Report noted some interesting statistics on old forests in the region that by defining criteria have not received a disturbance event (wildfire, logging, energy sector) for 120 years. He observed that while the Range of Natural Variability for this region's forest landscape created by an 80 year fire cycle ranges from 25-40% of the study area, old forests have declined considerably through collective disturbances during recent decades and now amount to ~10% of the landscape.

5.5 Timber Harvesting

During the last century, the forest sector changed from a landuse based on small family-based operations intended for subsistence purposes and local economies to one characterized by large scale operations conducted by companies who adopt advanced woodland and mill technologies. Small local logging operations prior to the 1960's generally relied on diameter-limit harvest strategies intended to remove the largest most desirable trees from cutovers.

Whereas softwood harvesting dominated logging operations in Alberta during the last century, the harvest of hardwoods (primarily aspen) has grown rapidly during the last three decades. Since the late 1980's, the proportional contribution of softwood fibre to total volume harvest has steadily declined. The significant increase in hardwood logging activity in northwest Alberta in the late 1980's can be attributed to new technologies that enabled the cost-effective pulping of hardwood tree species and markets desiring its qualtities – a development that lead to the construction of a pulp mill by DMI's Peace River Pulp Division. Engineered construction boards (e.g., OCB panel board) from deciduous trees also emerged as a market influencing harvest proportions. Figure 5.7 shows the trend in annual softwood and hardwood harvest volumes in northwest Alberta over the period 1966 to 1996 (Stelfox et al 1999).

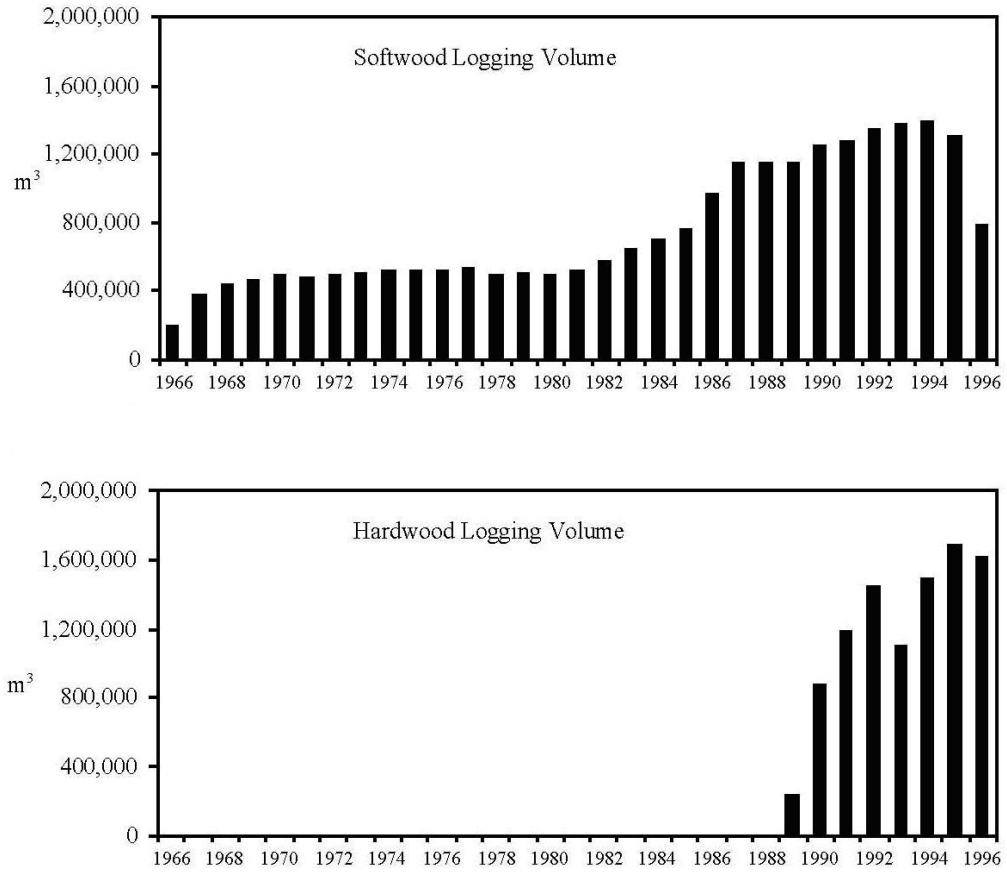


Figure 5.7 : Annual softwood and hardwood logging volumes in northwest Alberta

Source : Biophysical document, p8-19

Stelfox notes in his 2010 Cumulative Effects ALCES Report for northwest Alberta that forest production has grown exponentially in the region during the past 5 decades, currently standing at 1.6 million m3/year hardwood production while softwood production stands at 550,000m3/year.

Up until the late 1990's the forest sector in Canada, including DMI had relied on 2-pass (occasionally 3-pass) clear cutting as the dominant harvesting system for both softwood and hardwood harvest. Since the inception of ecological-based management much of the industry has transitioned at various levels to an experimental new form of sustainable forest management. Under this new paradigm that seeks to balance social, economic and environmental values some companies have begun exploring the use of variability in shapes and sizes of harvest blocks that also incorporate retention of structure (horizontal and vertical complexity) within them by allowing for retention of residual green trees. This is intended to address a host of biological and ecological values for ecosystem health and biodiversity conservation. As a new approach to human designed disturbance, it offers a closer fit to the natural analogue in boreal disturbance regimes.

Logging remains for the most part a highly seasonal activity in the region. Figure 5.8 and Figure 5.9 show how historical cutblock frequency and area harvested, respectively, generally increased from June through March, with minimal activity occurring during the

period from April through July. This pattern has evolved in northern Alberta as a factor of an extensive geographic mosaic of wetland areas and spring ground conditions which are not readily conducive to harvest or trucking, as well as federal Migratory Bird regulations that protect nesting birds from impacts during their vulnerable season. Since the mid 2000's new spatial tools for advance detection of wet areas (Wet Areas Mapping, LiDAR), new approaches to designing and managing seasonal haul roads, increased all-weather road infrastructure investment, and new harvest-system technology (portable-chipping in-forest log processing) have been coupled with a phased approach to logging stages (sour-felling). This enables some increased access to timber supply during the May to July period while addressing soil conservation, Migratory Birds conservation, and wetland challenges.

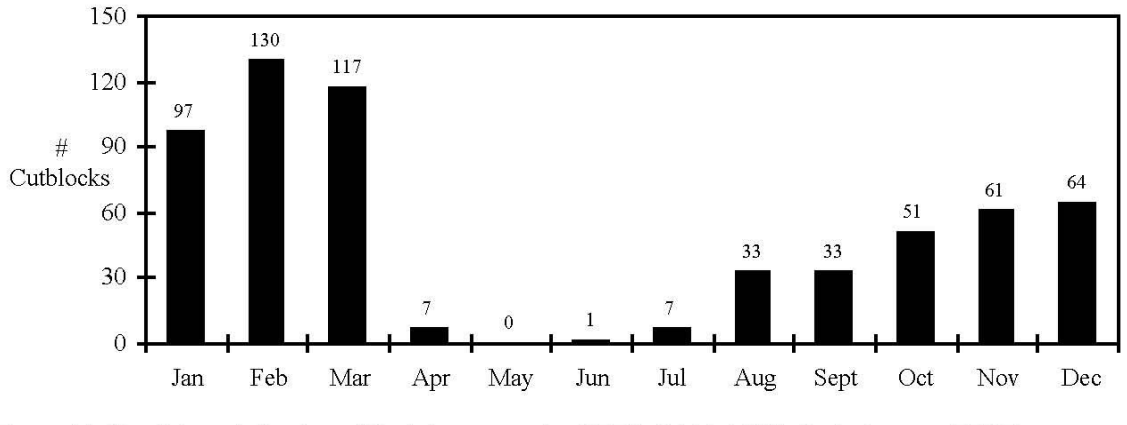


Figure 5.8 : Monthly variation in cutblock frequency for DMI (1989 to 1996)

Source : Biophysical document, p8-37

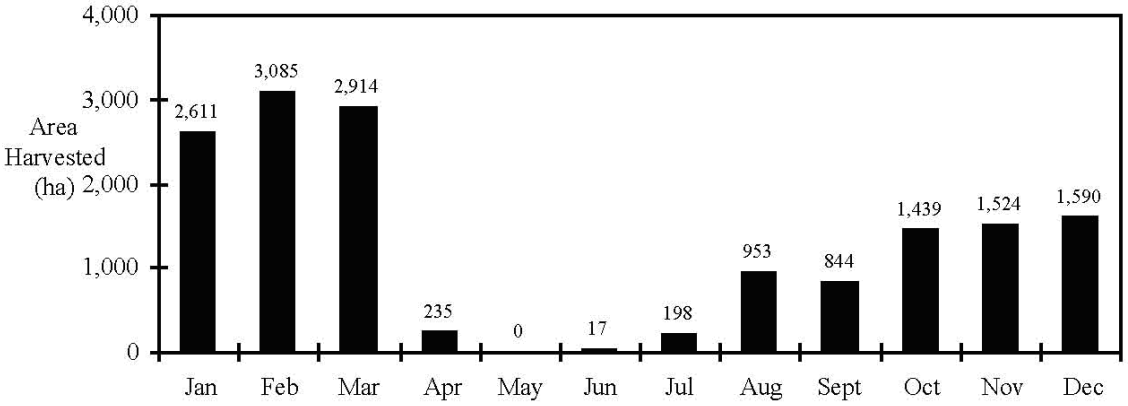


Figure 5.9 : Monthly variation in cutblock area for DMI (1989 to 1996)

Source : Biophysical document, p8-37

Under former harvest systems (2-pass), cutblock sizes were generally larger for hardwood than softwood harvesting, because of differing ground rules or regulations affecting harvest and regeneration strategies. Figure 5.10 shows the average monthly size for hardwood cutblocks on DMIs FMA area over the period 1989 to 1996. Under the new ecological-based management strategies introduced in 1999-2001, 2-pass

harvesting design, block size limitations and green-up rules (temporal constraints) have been removed. While the accumulated historical footprint of those former harvest systems still influences the outputs from patch-size analyses of local landscapes, a much greater range of harvest block sizes is practiced today within the region (e.g., 2 to ~700 hectares).

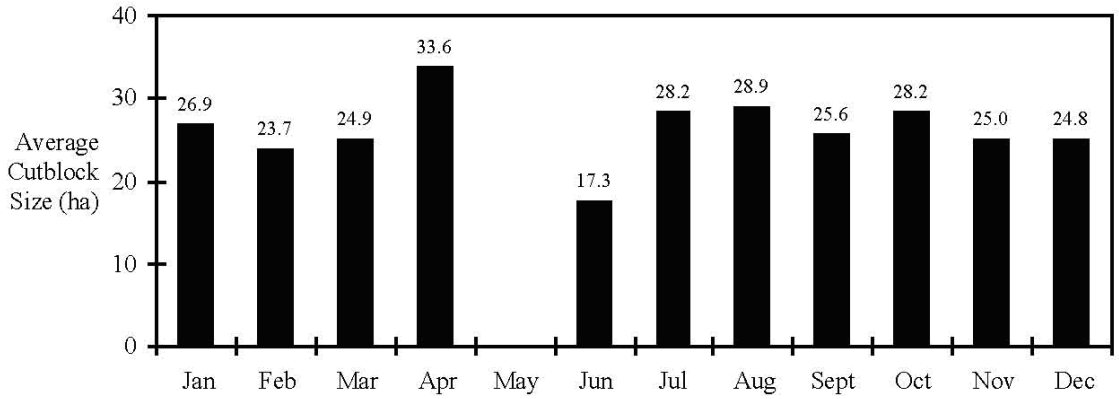


Figure 5.10 : Monthly variation in average cutblock size for DMI (1989 to 1996)

Source : Biophysical document, p8-37

Overlapping species-based tenures remain the tenure system in Alberta, and present distinct inter-company integration challenges on the boreal mixedwood landscape. Pure conifer and pure deciduous forest stands exist, but the species occur more often in spatially mixed arrangements in northwest Alberta. This necessitates the deployment of special planning and operational strategies in response to natural succession dynamics of these species that permit the cross-exchange of conifer and deciduous merchantable volumes harvested from each site between companies, but that also protect young conifer often found growing beneath and in association with deciduous trees (conifer understory). Harvesting mature deciduous and coniferous stems within areas containing immature conifer understory is a unique challenge which has been assisted by northwest Alberta research trials in harvest planning and logging techniques that are also monitoring post-operational performance of the young conifer. A long-range collaborative study involving local companies, the Canadian Forest Service and Alberta was initiated in the mid-1990's to inform this distinct forest management challenge and continues today (Hotchkiss Understory Research Project). The project has been vital in guiding the design of current practices within various gradients of conifer understory density. While the technology was primarily intended to assist mixed timber supply harvest strategies, it arguably contributes also to conservation of mixedwood dependent biodiversity, soils conservation, forest hydrology regulation, and conifer-dependent fur species persistence.

The prevailing approach to post-harvest regeneration of hardwood cutblocks remains a "leave for natural" strategy where regeneration occurs through aggressive suckering or coppicing characteristics of aspen. More invasive silvicultural approaches are generally used for softwood species, particularly white spruce, to encourage an improved seedling substrate. These strategies for white spruce cutblocks generally involve different types of blades, plows, or mounders to prepare the ground surface micro-sites. The most common approach to establishing spruce on cutblocks is to plant seedlings following the site preparation phase. In 2010, new Regeneration Standards for Alberta were initiated

that have refined requirements for surveys and performance, and that recognize inter-species succession dynamics and natural range of variation (spatial, temporal) that are characteristic of boreal mixedwood region ecology.

Geographic historical distribution of timber harvest within the DFA is illustrated to include the location of cut, planned (already laid out in the field) and future (pre-scheduled but not yet laid out) cutblocks in Figure 5.11. The cutblocks shown also include those that are not part of the DFA but which DMI has access to on neighbouring FMAs through Deciduous Timber Agreements (DTA).

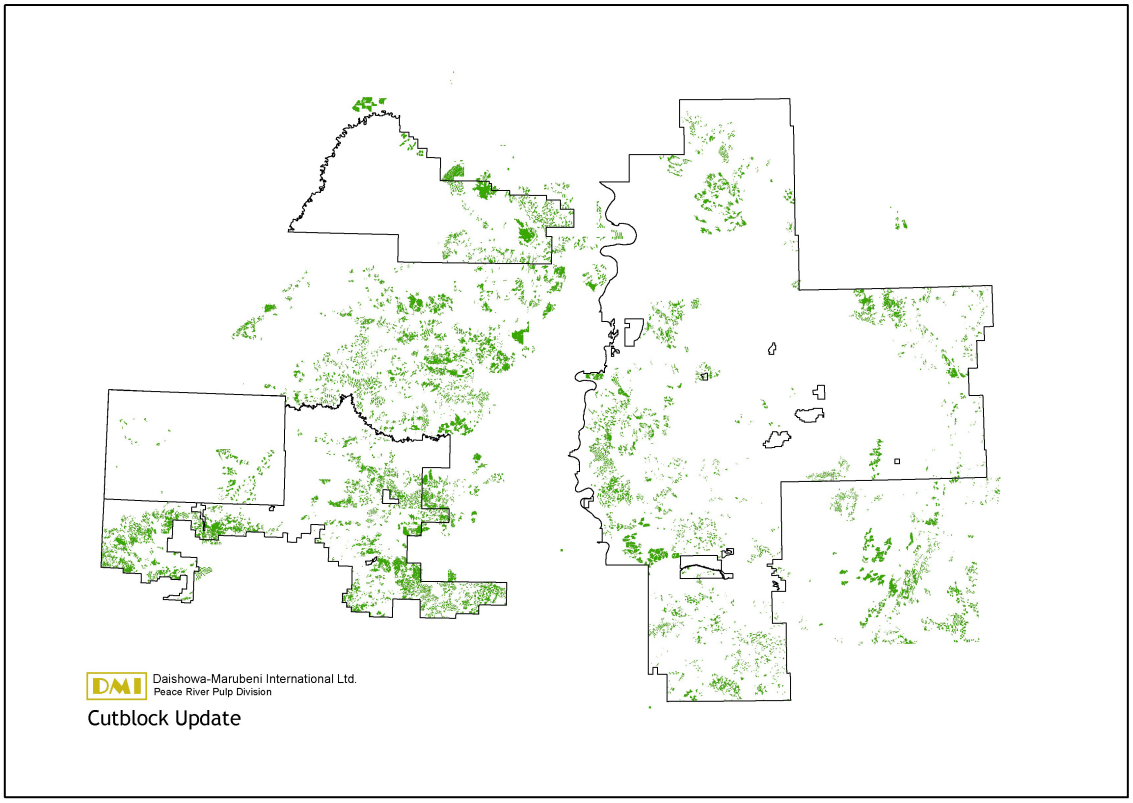


Figure 5.11 : Location of harvested, planned and future cutblocks on the DFA

Since 1999, the significance of bioenergy markets and economies has influenced forest operation technologies in-use both at forest products millsites and in field utilization practices within the region. By-products from log-processing that were previously considered waste have become increasingly targeted for use in co-generation processes that produce electrical power. Forest biomass ("hog-fuel") utilization and air emissions regulations have evolved to see dated handling techniques such as 'beehive burners' largely considered an obsolete practice. Portable processing technologies have been introduced and remain in a phase of developmental trials within the region both within harvest blocks and at millsites. Regulatory policy, guidelines and ecological thresholds associated with biomass utilization practices and forest ecosystem conservation are yet evolving in Canada in response to this new area of harvesting utilization.

Since 1999, harvest planning has also evolved significantly to reflect incorporation of ecological-based strategies within the Timber Harvest Planning and Operating Ground Rules that guide the design and delivery of timber harvesting within Alberta. The adoption of international concepts such as High Conservation Value Forests has further provided a centralized system for integrating timber harvesting disturbances with conservation of spatially defined special features of important value that exist on any landscape (cultural, social, biological, hydrological).

5.6 Forest Industry Access

Within northwest Alberta access infrastructure has been incrementally growing as a distinct forest disturbance since the area was initially opened for settlement and surveys in the early 1900's. Table 5.1 shows the existing access density on the FMAs among various road types.

Table 5.1 : Road density by FMA and FMU

FMU	Gross Area (km2)	2-lane undivided highway		High Grade Gravel		Low Grade Gravel		Truck Trail	
		Length (km)	Density (k/ km2)	Length (km)	Density (k/ km2)	Length (km)	Density (k/ km2)	Length (km)	Density (k/ km2)
MA EAST									
F1	38.4	0.0	0.0	69.1	1.8	64.1	1.7	219.4	5.7
P3	18.5	0.0	0.0	67.6	3.7	185.4	10.0	210.1	11.4
P4	38.9	102.4	2.6	180.6	4.6	171.1	4.4	332.7	8.6
P5	35.6	0.0	0.0	134.0	3.8	68.0	1.9	431.5	12.1
S15	44.3	176.6	4.0	0.0	0.0	419.9	9.5	639.3	14.4
Total	***175.7***	***279.1***	***1.6***	***451.3***	***2.6***	***908.4***	***5.2***	***1833.0***	***10.4***
MA WEST									
P19north	28.5	158.1	5.5	19.4	0.7	61.0	2.1	451.3	15.8
P19south	43.8	0.0	0.0	288.2	0.0	376.5	0.0	624.9	0.0
Total	***72.3***	***158.1***	***2.2***	***307.6***	***4.3***	***437.5***	***6.0***	***1076.2***	***14.9***
rand Total	***248.0***	***437.1***	***1.8***	***758.9***	***3.1***	***1345.9***	***5.4***	***2909.2***	***11.7***

The region's forests see access infrastructure developed by a collection of sources (agriculture and municipal development, oil and gas sector, forest sector, power and pipeline corridors development). The DFA is divided by an agricultural land-use zone that under the Third System of Survey has an established network of roads based on a square mile grid, pre-defined Road Allowances and sub-units of Townships. Within forested areas, rarely is access developed by one sector that does not become utilized by other sectors at some point in time, and even abandoned or temporary access and seismic lines become re-used by all sectors including the public. Consequently it is problematic to attempt quantifying the region's access disturbance footprint between some sectors, particularly the forestry and energy sector. Portions of each of the FMUs within the DMI DFA have extensive access infrastructure from a variety of these sources.

The rail network of northwest Alberta is not extensive but has played an important role in the historical development of the region, and in particular as a means of forest products

transportation to markets. Northwest Alberta is bisected by a north-south rail line running to the west of the Peace River maintstem from 56 to 58° N latitude and subsequently proximal to the west bank of the Hay River from 59 to 60° N latitude. Since 1999 portions of the railway infrastructure west of Peace River have been decommissioned as a consequence of agriculture market economies (Figure 5.12).

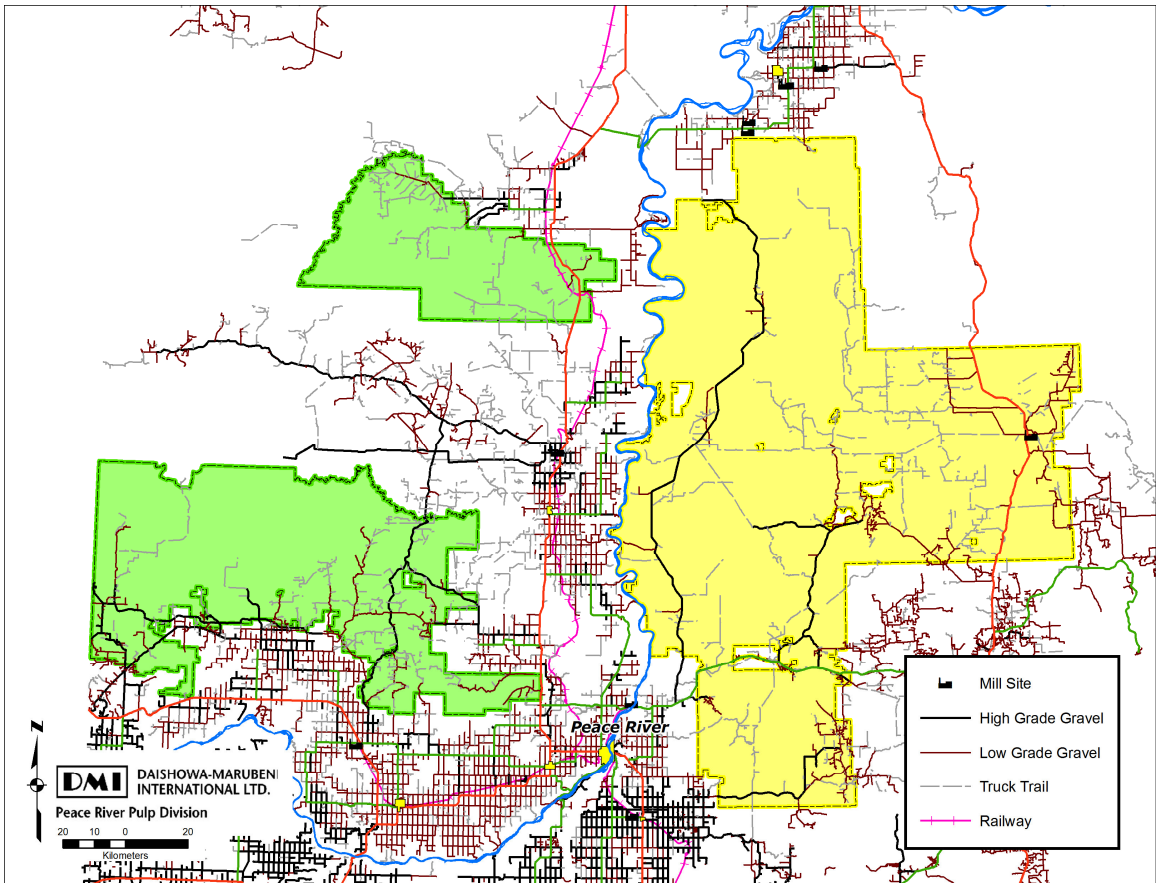


Figure 5.12 : Access in and around the DFA.

The region's access disturbance footprint was initially described in the 1999 *Biophysical* document (chapters 6 to 9, Stelfox et al). Stelfox 2010 Cumulative Effects ALCES report for northwest Alberta contains a number of sector-specific metrics describing current state and disturbance rate simulated into the future for different growth scenarios. He notes that forest sector disturbances (access and cutblocks) stabilize at 6%. His analysis shows that the cumulative linear footprint currently lies at a regional average of ~3km/km2, and that the pace of construction continues to outgrow the pace of reclamation in the region for all sectors combined.

To 2007 DMI had constructed approximately 227 km of all-weather main haul road, representing about two decades of long-term infrastructure development (Table 5.2).

Table 5.2 : DMI DFA All-Weather Roads (1989-2007)

Class II roads (1989-2007)	
Road	**Length (km)**
East Haul Road	128
Long Lake Road	15
Sulphur Lake Road	53
Keg River Road	10
Whitemud Tower Road	21
Total	**227**

DMI intends to present a strategic forest management access plan within the DFMP. In the interim, the company continues to utilize existing access (within Alberta's definition of existing) wherever possible. The company and others in the region continually seek opportunities for partnerships in road development and the use of common access corridors with other land users. This assists in both infrastructure cost efficiencies and as a means to control access disturbance rates and proportion.

5.7 Industrial Access and Development

During the last five decades, exploration, development, and extraction of petrochemical resources has left a significant disturbance imprint on the boreal forest landscape. Most conspicuous are the roads, seismic lines, well sites, processing facilities, pipelines and powerlines associated with this industry. Although it is difficult to ascertain what the final geographic distribution of oil and gas activities in northwest Alberta will be, it is recognized that existing oil, gas, and oil sand deposits are extensive and widely dispersed, and that these deposits will be extracted in a manner determined by available technology, market price, and reserve volumes.

Stelfox 2010 Cumulative Effects ALCES report for northwest Alberta[21] contains a number of specific metrics for this sector describing its current state and disturbance rate simulated into the future for different growth scenarios. At present oil production has grown exponentially in the region during the past 5 decades and in his analysis currently stands at ~6.5 million m3/yr. Gas production currently stands at ~3.0 billion m3/yr in the region. Within this context the DFA study area anthropogenic footprint (all landuse footrpints + cutblocks <20-years age) equates to ~200,000 ha (7.5%). That footprint excluding cutblocks equates to ~80,000 ha, but potentially grows to peak in 50-years at 225,000ha under the low hydrocarbon growth trajectory. He notes that during the past several decades, the majority (~65%) of forest core area has been lost, now representing ~35% of original levels in the region, and he attributes this primarily to high levels of linear edge densities. Stelfox projects an additional loss of 10% expected for all energy sector growth trajectory scenarios. The footprint of the energy sector he

[21] 2010., ALCES Landscape and Land-Use Ltd. (Stelfox et al)., An assessment of the cumulative effects of landuses in northwest Alberta. February 2010., Submitted to Royal Dutch Shell and DMI

calculates has grown to ~2% during the past 50 years and will continue to grow even under low trajectory scenarios for the next 50-years. Consequential to the hydrocarbon sector Stelfox forecasts the transportation sector footprint will also grow during that same period, all contributing incrementally to industrial forest disturbance. Reclamation of landuse footprint is currently at ~500ha/year. He projects that both hardwood and softwood production will remain sustainable yet declining moderately due to merchantable landbase losses through energy sector activity, however wildfire disturbance remains the largest landscape influence.

Geophysical exploration (seismic) line disturbances form a significant portion of linear access-related disturbances, and are inherently an important part of the transportation network in the region. The energy sector, as an originating source of seismic lines, may reuse lines for exploration purposes or as subsequent access to wellsites and production infrastructure. Other industries including the forest sector and, in the past decade mineral companies (aggregates, diamond, iron) also depend on such access for reconnaissance planning and operations. Recreational activities of local hunters, trappers, hikers, and the off-road vehicle community all use seismic lines to access the forest extensively. These combined factors present a challenge to forest succession, forest productivity and forest recovery rates following initial line clearing that as a form of disturbance has no natural analogue in boreal disturbance regimes.

Seismic lines are the largest and most conspicuous disturbance feature on the forest landscape caused by the oil and gas sector. As of 2009, 64,116 km of seismic lines had been cut in the DFA, resulting in approximately 30,789 to 40,179 ha of area harvested (presumes a footprint width average at 5-meters, and that not all linear disturbance occurs on productive upland forests contributing to timber supply). The spatial distribution and density of seismic line activity varies across the DFA. Comparing current seismic footprint on an FMU basis shows that the linear distance of existing footprint varies from a minimum of 4096 km in P19n to a maximum 15,617 km in P19s. The current network of seismic lines across the DFA area is shown in Figure 5.13.

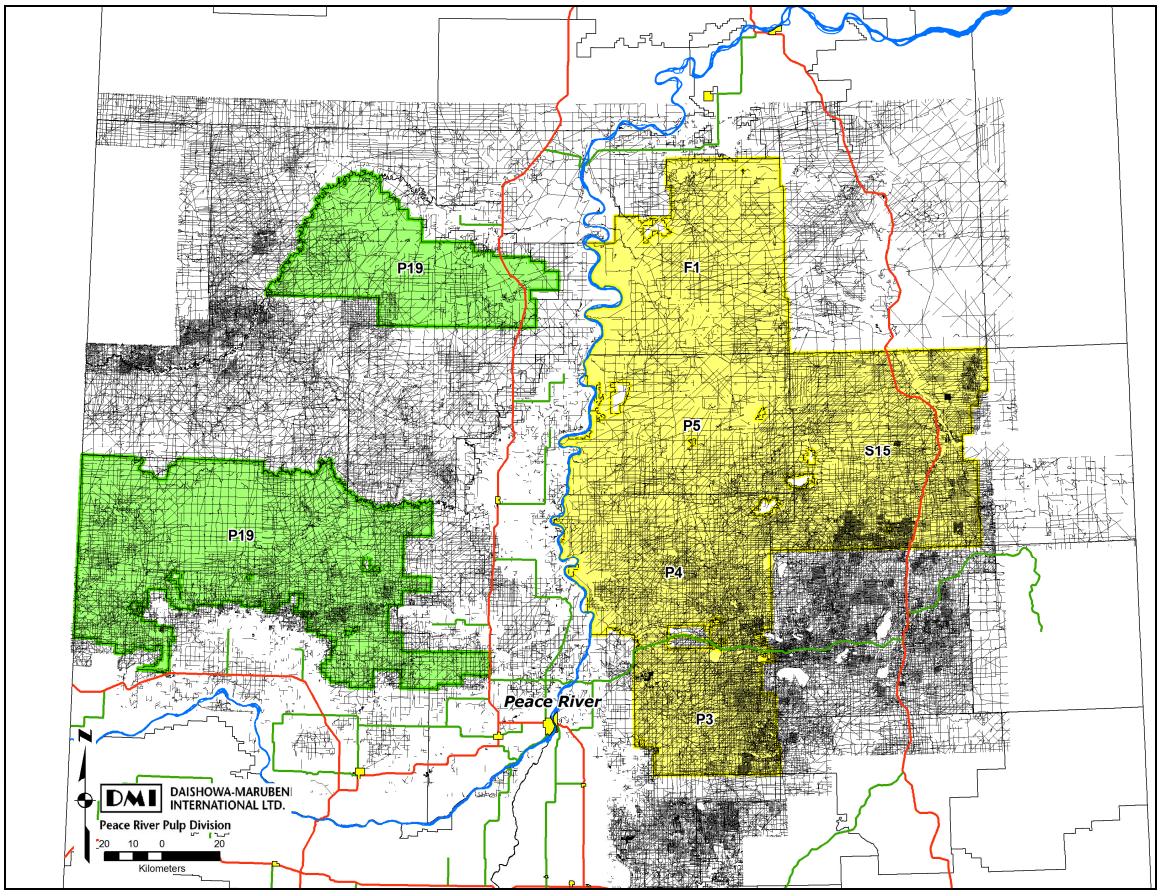


Figure 5.13 : Seimic lines and trails on the FMAs.

Roads are the second major source of linear disturbance within the region associated with combined sectors. Quantified footprint for such access is presented in the previous section (Table 5.1). Once established, roads are generally used by many land-users including extensive use by the public for numerous recreational activities. Other sources of disturbance to the landscape caused by the hydrocarbon sector include well sites, gas processing plants, oil processing facilities, and pipelines (water, steam, product) that within the region may be either above ground or sub-surface infrastructure. To a lesser extent other miscellaneous disturbance footprint occurs through aggregate exploitation (sand, gravel) and electrical power transmission.

Among industrial disturbances that result in long-term forest cover removal, well sites, roads under License of Occupation, and utility corridors (pipelines, powerlines) dominate both frequency and area of dispositions for the northwest Alberta region. Although the ranked order of disposition frequency is well sites, followed by roads and pipelines, ranked order of area (hectares) of dispositions is roads, pipelines and wellsites. Increasingly with provincial infrastructure development, powerline easements are becoming considerable in both frequency and area.

Figure 5.14 shows current distribution of industrial disturbances on the DFA caused by roads, oil & gas activity and other industrial users. It includes disturbances caused by rights-of-way, plant-sites, gravel pits, pipelines, powerlines, airstrips and wellsites.

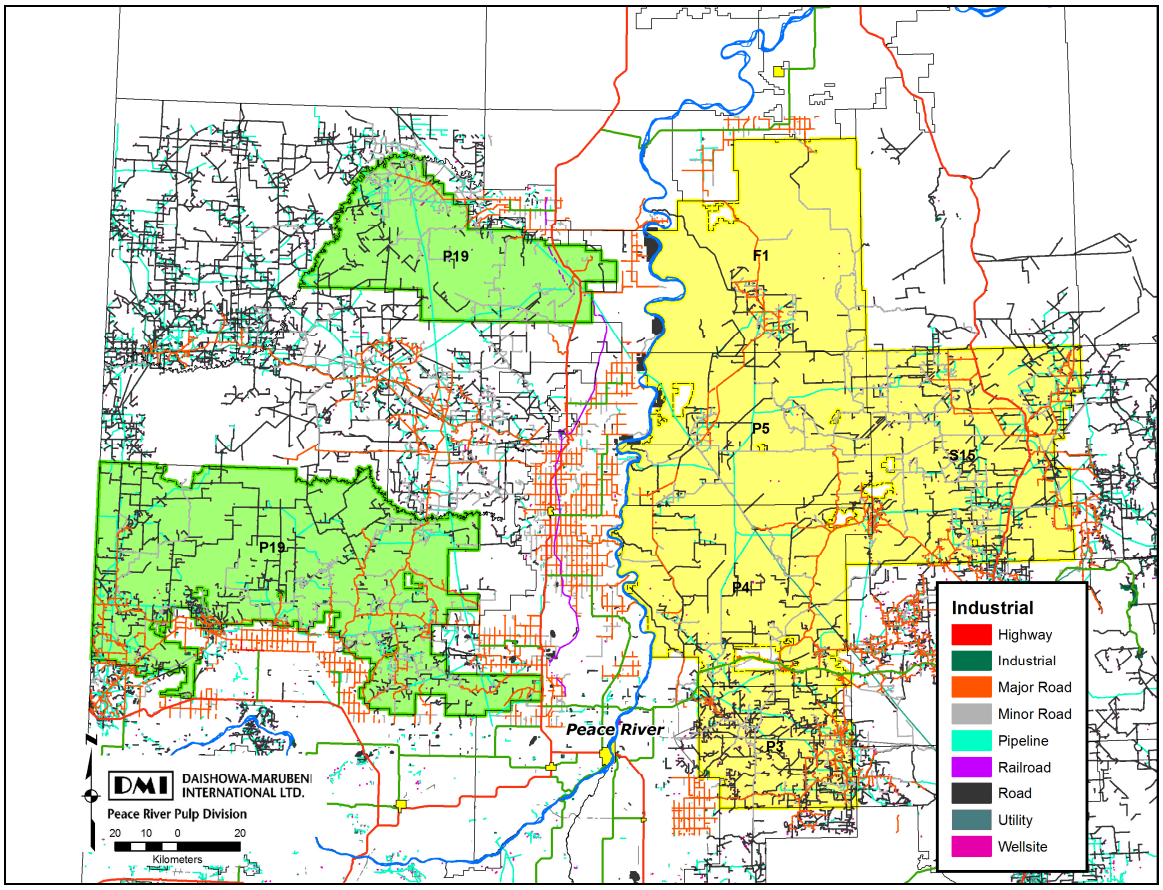


Figure 5.14 : Industrial disturbances on the FMAs.

5.8 Monitoring Sites

Within the DFA, monitoring sites for various purposes have been established; either independently by DMI or with other companies or associations. These monitoring sites include, permanent sample plots (PSP), temporary sample plots (TSP), Western Boreal Growth and Yield Association[22] (WESBOGY) sample plots, Northern Interior Vegetation Management Association (NIVMA) research sites, Mixedwood Management Association[23] (MWMA) research plots, and a CFS research block (P4 FMU). In addition two large-scale research projects are monitoring a variety of themes through a collaboration of various agencies, forest sector companies and academic institutions.

The Canadian Forest Service (CFS) is leading a study monitoring understory conifer response to innovative harvest techniques established in the mid-1990's on a large area of forest northwest of Manning outside the DMI west-FMA (Hotchkiss Understory Conifer Study). The outcomes have and will continue to inform refinement of practices and policy in managing landscapes for multiple integrated wood supplies. An extensive collection of plots (~600) and replicated treatment sites (1000ha) was established following 2-years of design (1997-1999) within a 7000 hectare area of forest northwest of

[22] http://www.ales.ualberta.ca/rr/wesbogy.cfm

[23] http://www.mwma.rr.ualberta.ca/

Peace River within DMI's west-FMA (EMEND research forest –Ecosystem-based Management Emulating Natural Disturbance). EMEND projects have involved a partnership of provincial and federal governments, industry, a collection of universities and some research-based institutes (FP –Innovations-FERIC, Foothills Research Institute, Boreal Research Institute, Alberta Innovates –Alberta Research Council). Projects at the research forest are monitoring for ecosystem response and thresholds under wildfire and industrial harvest disturbances. They are informing experimental ecological-based management strategies and practices, as well as evolving provincial policy and biodiversity targets. The suite of EMEND projects have also notably been establishing valuable baseline data on biotic inventory and ecosystem processes that will continue to assist landscape management decisions for a variety of sectors and government policy, current forest utilization systems and evolving markets (e.g. biomass, carbon offsets).

Table 5.3 shows the total area (hectares) committed to various monitoring and research sites located on the DFA, while Figure 5.15 shows the geographic location of those sites. The Hotchkiss Understory Conifer Study site is not illustrated in these as this study is outside of DMI's FMAs.

Table 5.3 : Area (ha) by type of monitoring or research site

Site	FMA East						FMA West					Total
FMU	F1	P3	P4	P5	S15	Total	P10	P11	P1N	P13	Total	
CFS			44.4			44.4						**44.4**
EMEND										7,376.9	7,376.9	**7,376.9**
MWMA										1.9	1.9	**1.9**
NIVMA	0.3		0.3	0.6	0.1	1.3	0.4			0.8	1.3	**2.5**
PNT020092										1.5	1.5	**1.5**
PNT040360			1,475.4			1,475.4						**1,475.4**
PNT050181										80.8	80.8	**80.8**
PNT080050										257.0	257.0	**257.0**
PNT950071	16,972.5			20,018.4		36,990.8						**36,990.8**
PNT950172			33.0			33.0						**33.0**
PNT990009	32.6					32.6						**32.6**
PSP1990		44.4	100.6	40.3	126.6	311.9	27.0			143.4	170.4	**482.3**
PSP2005	57.7	35.8	66.1	65.3	46.8	271.6	51.1	4.4		196.4	252.0	**523.6**
PSPGOV			22.9		13.9	36.8	45.8	2.2		156.3	204.3	**241.1**
TSP1999		3.4	6.7	5.5	6.7	22.3	4.8			7.9	12.7	**35.0**
TSP2005	0.6	0.8	2.0	1.7	2.3	7.4	1.4	0.1	2.0	4.3	7.8	**15.2**
WESBOGY										84.2	84.2	**84.2**
Grand Total	**17,063.6**	**84.5**	**1,751.3**	**20,131.8**	**196.3**	**39,227.6**	**130.5**	**6.7**	**2.0**	**8,311.5**	**8,450.8**	**47,678.4**

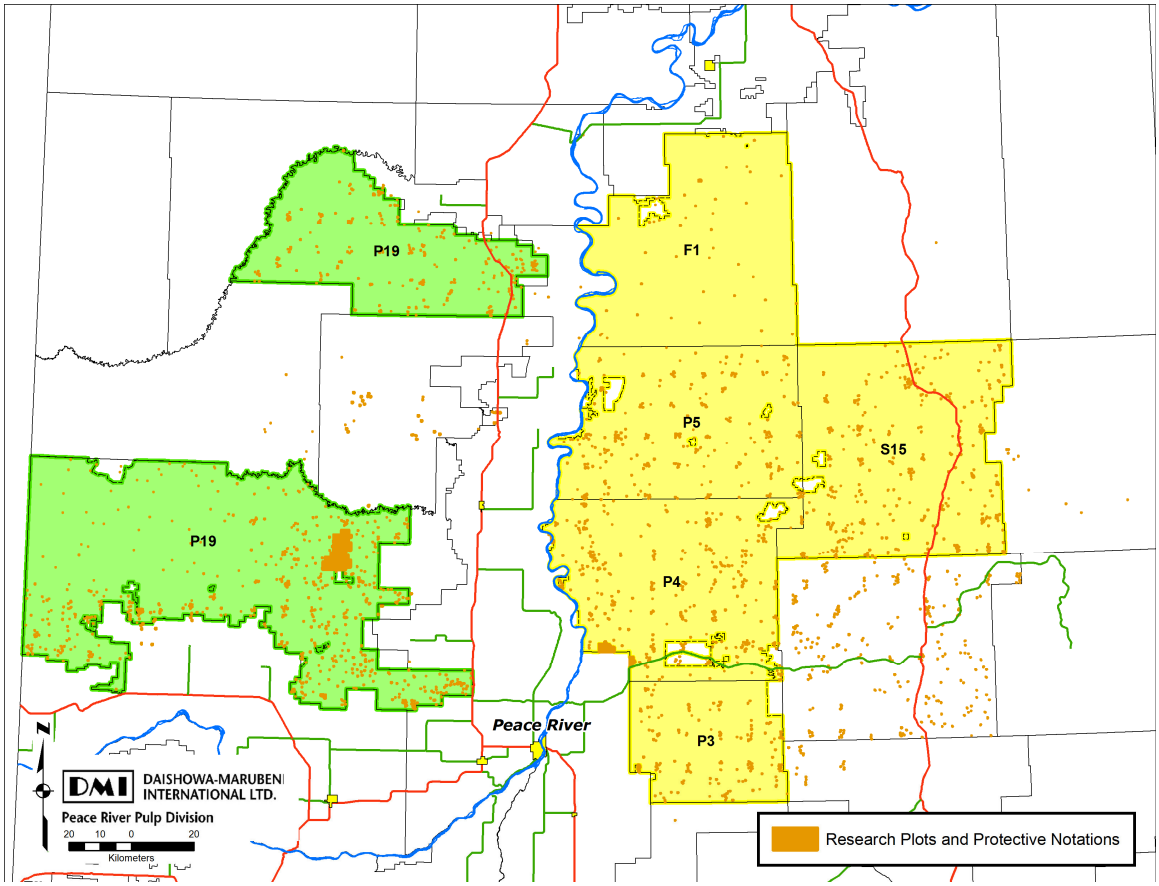


Figure 5.15 : Location of monitoring and research sites on the DFA

6 Landscape Fire Assessment

Fires are frequent natural and human-caused events in northwest Alberta. The area is not characterized by a single fire regime, but rather geo-specific differences in landform and climate appear to affect fire behaviour by altering forest structure and fire weather characteristics. Fires tend to be highly seasonal, generally peaking in frequency and area in mid-summer (July) in forested communities and in May in grassland communities. Fires in aspen dominated forests tend to peak earlier (May) than in those forests dominated by coniferous trees (June-July). Although small fires are common, infrequent large fires account for the vast majority of area burned. Fires vary in intensity, with black spruce and pine forest types experiencing greater levels of tree mortality than do stands dominated by aspen or white spruce. Historically, lightning has been the dominant cause of fire, however the number of fires started by humans has been increasing over the past few decades. With the increasing range of forest values, growing presence of human residences within or proximal to forests, human infrastructure investments within those forests, and the anticipated increasing future challenges in fire weather (climate change), the concept of landscape fire assessments have taken on heightened importance in the Province's management.

6.1 Wildfire Threat Assessment

Development of Wildfire Threat Assessments under the Province's FireSmart program is a component of management strategy associated with a 2010 Alberta directive on forest tenure roles and responsibilities (February 2010). Consequently, this section will be provided by Alberta Sustainable Resource Development in due course as that assessment evolves and will cover fire behaviour potential, fire occurance, values at risk and suppression capability.

6.1.1 Fire Behaviour Potential

ASRD responsibility

6.1.2 Fire Occurrence Risk

ASRD responsibility

6.1.3 Values At Risk

ASRD responsibility

6.1.4 Suppression Capability

ASRD responsibility

6.2 Fire Regime Analysis

Stelfox et al provided a detailed preliminary analysis and comprehensive description of the character of fire disturbance regimes in northwest Alberta as presented in Chapter 5 of the *Biophysical* document. His analyses drew accrued historical wildfire and land data from a relatively short period of 5-7 decades. It remains relevant background in presenting a discussion of significant aspects on the history of landscape modification within these northern boreal forests including: fire causal origin, locations distribution, fire frequency, fire size, temporal patterns, as well as relationships to stand characteristics, weather patterns and natural sub-regions. This section provides a summary of the pertinent findings of those analyses which facilitate an understanding of natural disturbance, the Natural Range of Variability (NRV) in landscape influence and how local fire regimes informed the development of core principles and local applications of ecological-based management strategies for the DFA area. The analysis was conducted using data collected from various sources over the period 1961 to 1995. Table 6.1 provides a summary of selected statistics for the fires used in that preliminary analysis.

Table 6.1 : Fire Count and Fire Size Statistics -Northwest Alberta (1961 – 1995)

Source : Biophysical document, p 5-18

Statistic	Value
Total Fire Count	6,676
Total Area Burnt (Ha)	1,656,729
Minimum Fire Size (Ha)	0.1
Maximum Fire Size (Ha)	223,991.3
Mean Fire Size (Ha)	248.2
Median Fire Size (Ha)	0.4
Standard Deviation (Ha)	4,418.3

Table 6.1 demonstrates that wildfires are a common event in northwest Alberta and exhibit considerable variation in size as evidenced by a median size of 0.4 ha, standard deviation of 4,418 ha, and maximum size of 223,991 ha. This 1999 work was fundamental in establishing that wildfire is the dominant driver of landscape dynamics, boreal forest complexity and stand-level structure within the northwest boreal region. It affirmed that natural disturbance is a valid analogue on which to base forest management strategies that target NRV. It therefore formed the basis for designing an approach to emulate and integrate some aspects of that natural analogue within local forest management strategies and harvest design practices.

6.2.1 Fire Season

Fire incidence and area burned is strongly seasonal with peak activity occurring in mid-summer. July contributes the most fires, area burned (74%) and the highest average fire size, as shown in Table 6.2 and Figure 6.1. The highest amount of yearly variability in fire size also occurs in the month of July. Fires occur infrequently during November to

March, many of which are anthropogenic. The official fire season for the area is from April 1 to September 30.

Table 6.2 : Frequency of fire and area burned by month (1983 to 1992)

Source : Biophysical document, p 5-24

	No of Fires		Area Burned		Average Fire Size
	Count	%	Ha	%	Ha
January	6	0.3%	52	0.1%	8.72
February	7	0.3%	1	0.0%	0.16
March	11	0.5%	7	0.0%	0.61
April	108	4.9%	3,841	5.1%	35.57
May	350	15.8%	5,116	6.8%	14.62
June	432	19.5%	6,487	8.6%	15.02
July	568	25.6%	55,569	73.8%	97.83
August	532	24.0%	2,337	3.1%	4.39
September	107	4.8%	1,770	2.4%	16.54
October	77	3.5%	138	0.2%	1.79
November	10	0.5%	1	0.0%	0.11
December	7	0.3%	5	0.0%	0.70
Total	**2215**	**100.0%**	**75,325**	**100.0%**	**34.01**

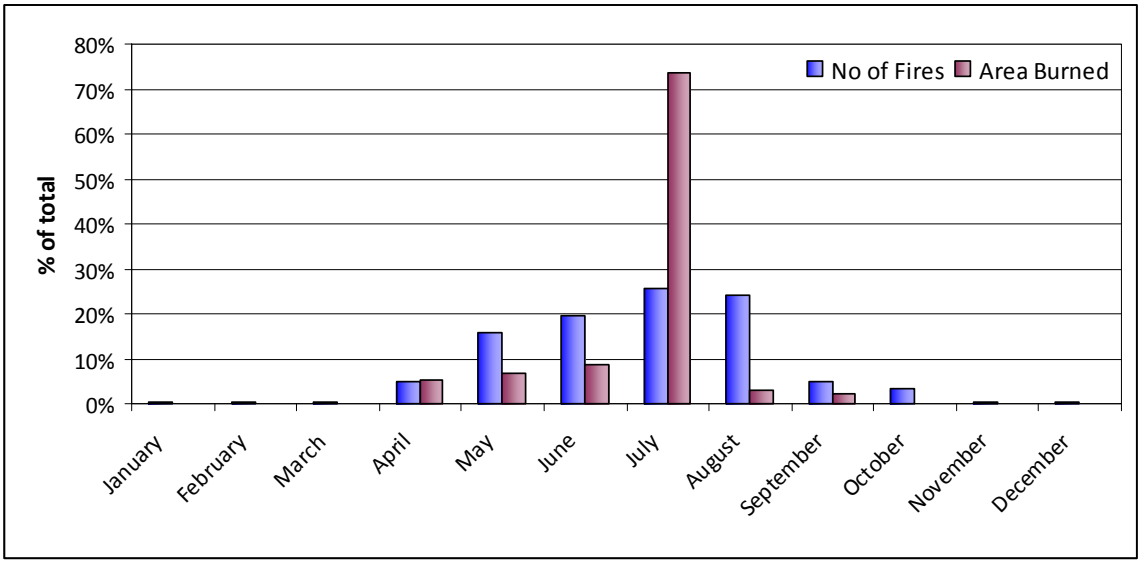


Figure 6.1 : Number of fires and area burned by month (1983 – 1992).

6.2.2 Fire Type

Fires occur throughout northwest Alberta and originate from a variety of causes including, lightning, residential, recreation, unknown, industry (excluding forestry and rail), incendiary, railroad, forest industry, and public projects. Of these ignition sources, lightning fires are most frequent and account for 57% of fires and 97% of total area burned between 1961 and 1995, as presented in Table 6.3 and Figure 6.2.

Table 6.3 : Frequency of fire and area burned by fire origin (1961 – 1995)

Source : Biophysical document, p 5-62 and 5-63

Fire Origin	No of Fires		Area Burned		Average Fire Size
	Count	%	Ha	%	Ha
Incendiary	380	5.7%	20,189	1.2%	53.13
Lightning	3826	57.3%	1,603,813	96.8%	419.19
Other Industrial	390	5.8%	2,359	0.1%	6.05
Public Project	59	0.9%	190	0.0%	3.22
Railroad	74	1.1%	362	0.0%	4.89
Recreation	557	8.3%	3,951	0.2%	7.09
Resident	868	13.0%	16,176	1.0%	18.64
Unknown	434	6.5%	8,420	0.5%	19.40
Wood Industrial	88	1.3%	1,270	0.1%	14.43
Total	**6676**	**100.0%**	**1,656,730**	**100.0%**	**248.16**

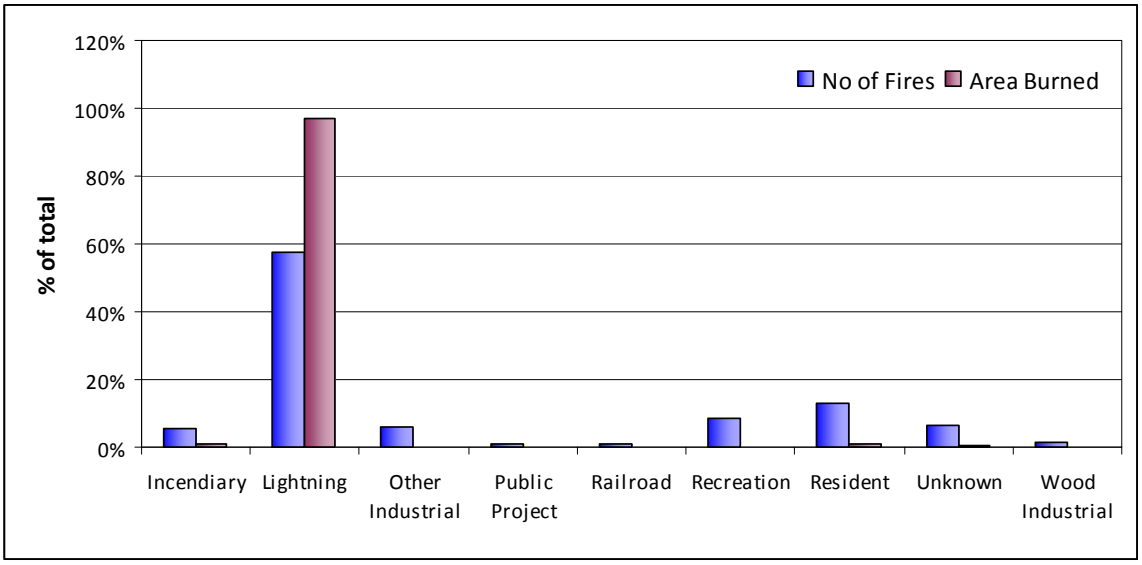


Figure 6.2 : Number of fires and area burned by fire origin (1961 – 1995)

Local residents (13%) were the most frequent anthropogenic source of ignition over the study period. Incendiary fires, however resulted in the most area burned (1.2%) from

fires originating from anthropogenic sources. The incidence of anthropogenic sources of fire was highest where human settlements, agriculture, and transportation corridors are most prevalent.

Comparisons of lightning-caused and human-caused fires indicate a similar trend between 1961 and 1995, suggesting that weather and fuel conditions affect both fire sources in a similar fashion. Although human-caused fires account for approximately 40% of all fire starts, they contribute less than 4% of the area burned.

The density of lightning strikes in northwest Alberta is illustrated in Figure 6.3. Overlain on a digital elevation map the locations of lightning-caused fires appear to be influenced by topography. The locations of lightning caused fires tend to be concentrated on the higher elevations particularly along the west-facing slopes, whereas fewer fires occur on the lee-side or eastern slopes immediately adjacent to these upland areas. Yet it is also apparent that few if any areas of the northwest region are immune to fire events.

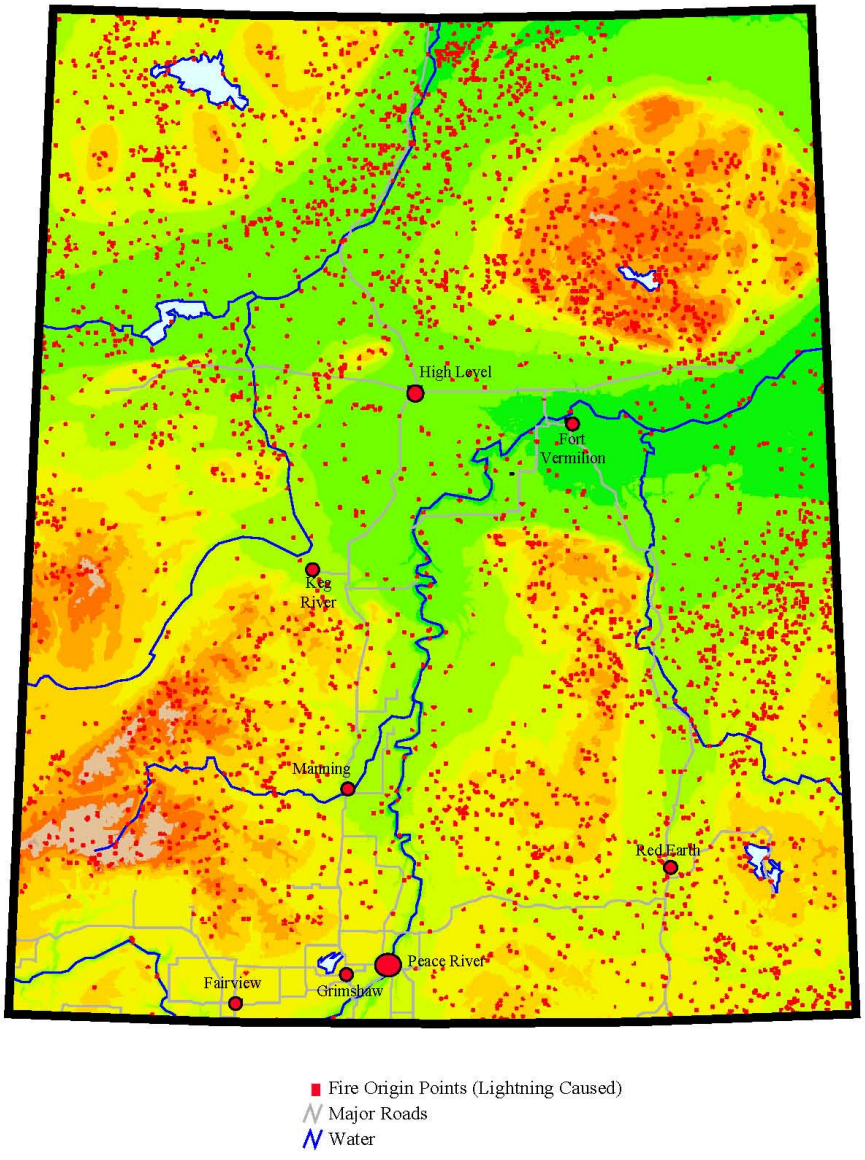


Figure 6.3 : Location of fire origins caused by lightning (1961 to 1995)

6.2.3 Fire Severity

The following analyses are based on those DMI AVI stands that were given fire modifier calls by photo-interpreters. It is important to note that modifiers were only applied to those stand polygons that experienced some level of canopy mortality and therefore do not consider those interior regions of the fire that are true skips (i.e., patches that received no level of fire causing tree mortality). Estimates of green tree survivorship would be higher if AVI polygons representing unburned skips within Class E (> 200ha) fires were included. The absence of fire modifier calls on AVI polygons created by smaller fires (Class A to D) suggests that photo interpreters were unable to detect fire boundaries. As such, the analyses and interpretations are restricted to the larger fire events.

Based on the fire modifier calls of 5,415 young forest stands evaluated for canopy mortality (pre-1999), it can be inferred that stands were initiated by fires of variable intensity, as shown in Table 6.4 and Figure 6.4. Of the fire various intensity levels, stands initiated by fires that killed the entire canopy were most common, amounting to 59% of all stands sampled. Stands initiated by fire intensity resulting in lower levels of canopy mortality were represented in approximately equal proportions of about 10%. When patterns of fire intensity are examined by area contributions rather than by frequency, it becomes clear that the majority of the stands (80%) were initiated by fires that caused full crown mortality.

Table 6.4 : Frequency of fire and area burned by fire intensity level

Source : Biophysical document – table 19 on page 5-55

Canaopy Mortality Level	Fire Intensity Level	No of Fires		Area Burned		Average Fire Size
		Count	%	Ha	%	Ha
1 to 25%	1	445	8.2%	5,051	4.0%	11.35
26 to 50%	2	601	11.1%	5,572	4.4%	9.27
51 to 75%	3	584	10.8%	5,513	4.3%	9.44
76 to 94%	4	591	10.9%	9,811	7.7%	16.60
95 to 100%	5	3,194	59.0%	100,913	79.5%	31.59
Total		**5,415**	**100.0%**	**126,860**	**100.0%**	**23.43**

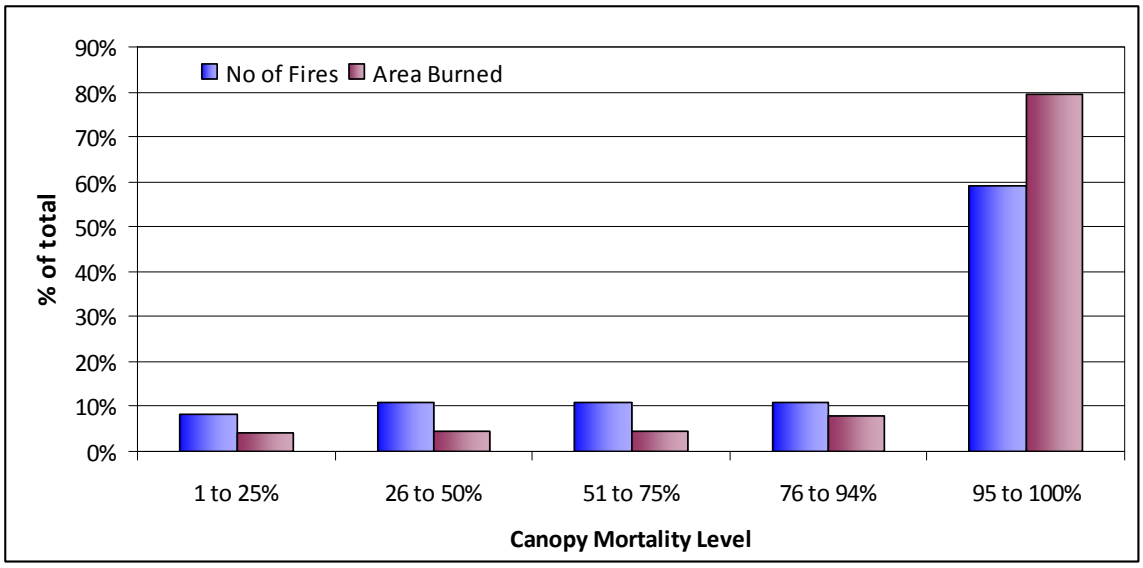


Figure 6.4 : Number of fires and area burned by fire intensity level

6.2.4 Fire Frequency and Fire Size

Significant annual variation in fire frequency, area burned, and average fire size occurred over the pre-1999 study period as shown in Table 6.5, Figure 6.5 and Figure 6.6, with total area burned exhibiting greater temporal variation than fire frequency. Year-to year variation also increased with fire size; i.e., frequency and area of small fires are relatively constant year-to-year, whereas large fire events are sporadic events. As evaluated by area burned, fires in northwest Alberta were most pronounced during 1981 and 1982. During these two years, average fire size was significantly higher than other years and more land burned in northwest Alberta than in the other 33 years combined.

Simple linear regression on the annual fire count (Figure 6.5) shows an increasing trend in the number of fires in the study area over the study period.

Table 6.5 : Frequency of fire and area burned by year (1961 – 1995)

Source : Biophysical document, p 5-26 and 5-27

Year	No of Fires		Area Burned		Average Fire Size
	Count	%	Ha	%	Ha
1961	119	1.8%	23,906	1.4%	200.89
1962	36	0.5%	207	0.0%	5.75
1963	98	1.5%	2,011	0.1%	20.52
1964	42	0.6%	1,260	0.1%	30.00
1965	80	1.2%	21,688	1.3%	271.10
1966	127	1.9%	22,822	1.4%	179.70
1967	177	2.7%	2,882	0.2%	16.28
1968	80	1.2%	1,901	0.1%	23.76
1969	141	2.1%	22,019	1.3%	156.16

Year	No of Fires		Area Burned		Average Fire Size
	Count	%	Ha	%	Ha
1970	192	2.9%	23,364	1.4%	121.69
1971	272	4.1%	49,611	3.0%	182.39
1972	217	3.3%	8,370	0.5%	38.57
1973	82	1.2%	769	0.0%	9.38
1974	101	1.5%	578	0.0%	5.72
1975	151	2.3%	3,899	0.2%	25.82
1976	119	1.8%	742	0.0%	6.24
1977	96	1.4%	2,620	0.2%	27.29
1978	135	2.0%	1,736	0.1%	12.86
1979	154	2.3%	5,236	0.3%	34.00
1980	431	6.5%	158,880	9.6%	368.63
1981	355	5.3%	401,017	24.2%	1129.63
1982	377	5.6%	577,302	34.8%	1531.31
1983	223	3.3%	380	0.0%	1.70
1984	345	5.2%	66,646	4.0%	193.18
1985	205	3.1%	11,375	0.7%	55.49
1986	190	2.8%	486	0.0%	2.56
1987	180	2.7%	10,545	0.6%	58.58
1988	90	1.3%	443	0.0%	4.92
1989	243	3.6%	384	0.0%	1.58
1990	418	6.3%	4,429	0.3%	10.60
1991	209	3.1%	1,598	0.1%	7.65
1992	175	2.6%	676	0.0%	3.86
1993	266	4.0%	15,458	0.9%	58.11
1994	264	4.0%	20,979	1.3%	79.47
1995	286	4.3%	190,513	11.5%	666.13
Total	**6,676**	**100.0%**	**1,656,732**	**100.0%**	**248.16**
Annual Avg	**191**		**47,335**		**248.16**

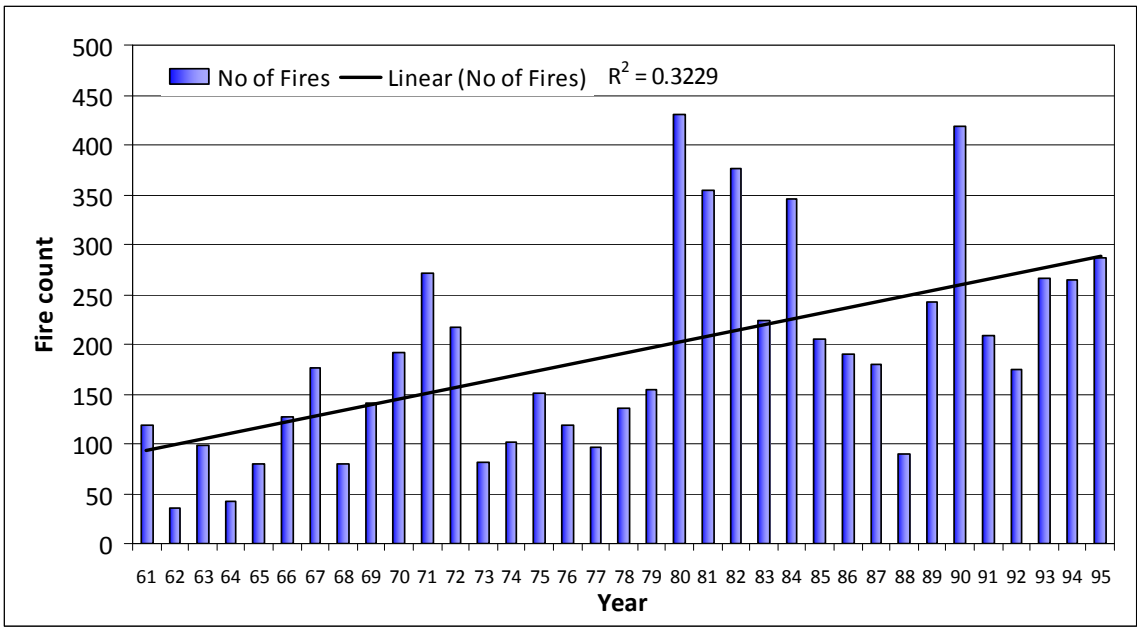


Figure 6.5 : Number of fires by year in northwest Alberta (1961 to 1995)

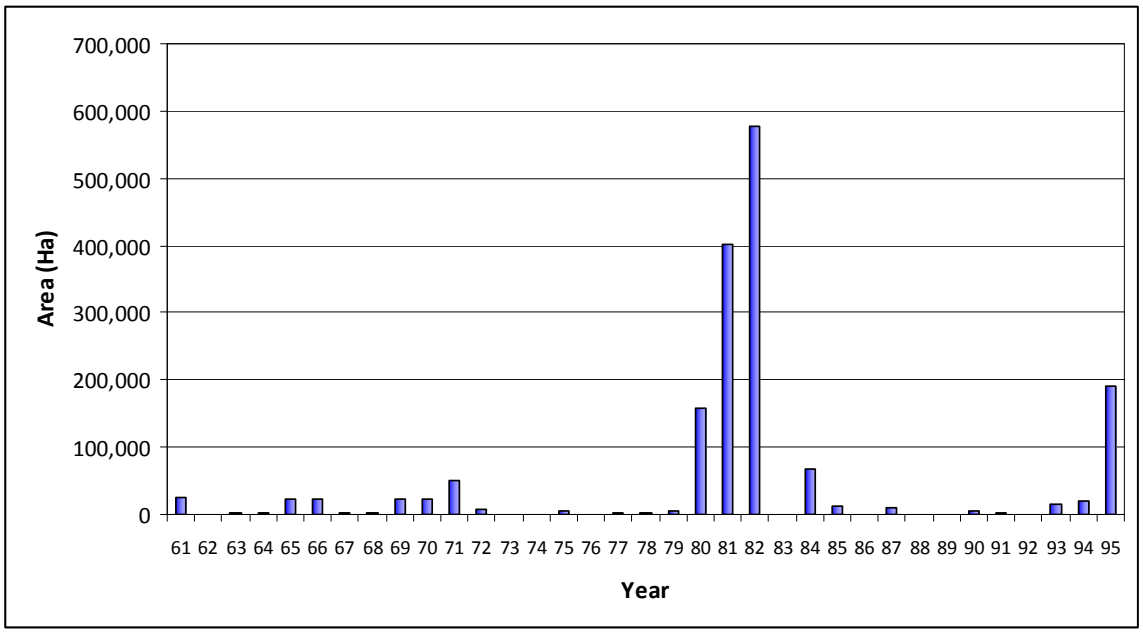


Figure 6.6 : Area burnt by fires by year in northwest Alberta (1961 to 1995)

Wildfire ignition and spread is strongly influenced by type and availability of fuel. A subset (1983 to 1992) of the 1961 to 1995 dataset contained forestry canopy fuel information and was used to examine relationships between fire events and canopy tree composition. This dataset consisted of 2,215 fires that burned a total of 75,325 ha. Fuel type categories (black spruce, white spruce, deciduous, pine, mixedwood, treed muskeg and grass) refer to those forest covers occurring at the fire origin location and may not accurately reflect the fuel composition of the entire fire area. Figure 6.7 and Figure 6.8 summarise the frequency of fires and total area burnt for each cover type.

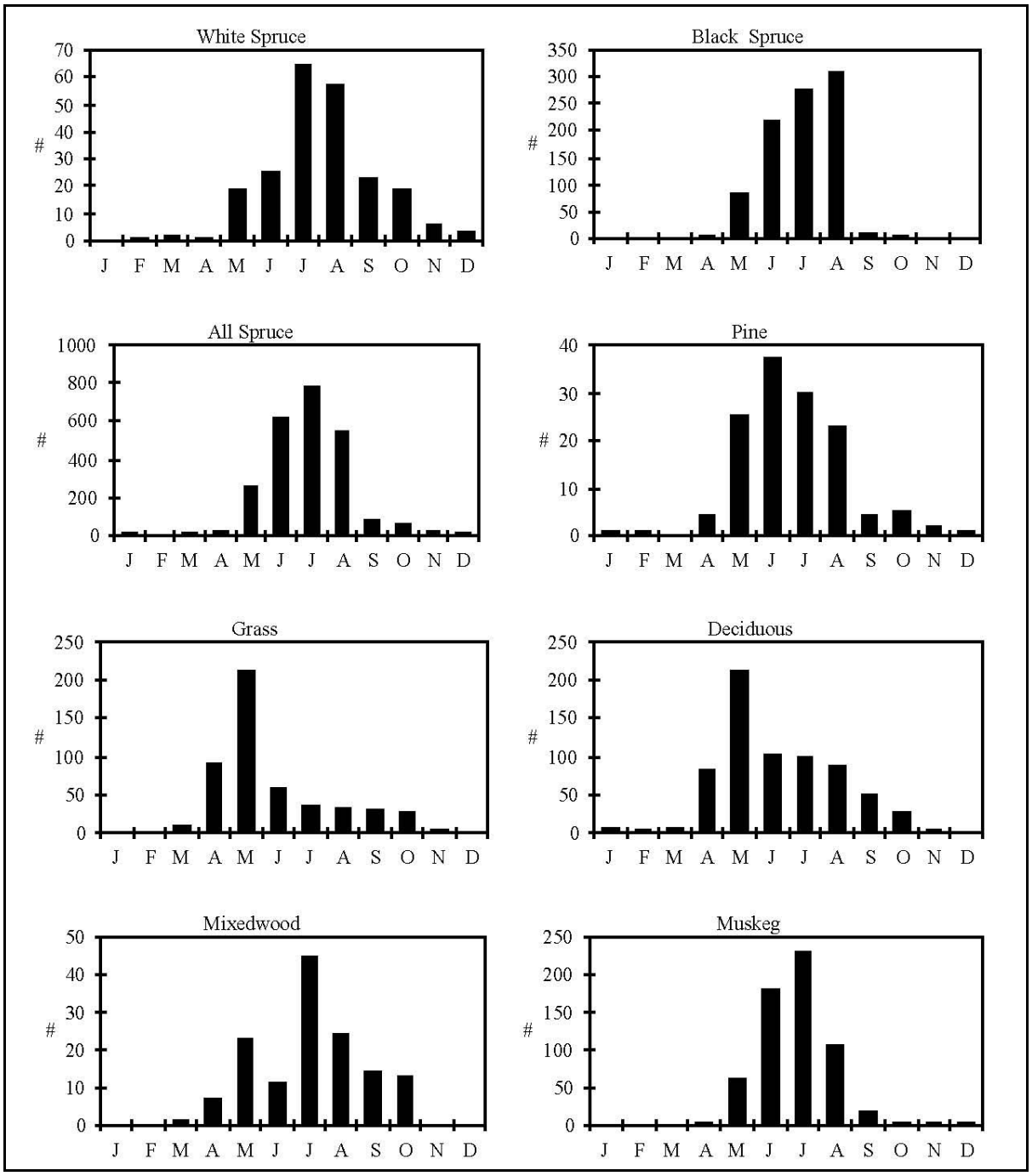


Figure 6.7 : Fire frequency by fuel type for each month (1983 to 1992)

Source : Biophysical document, p 5-39

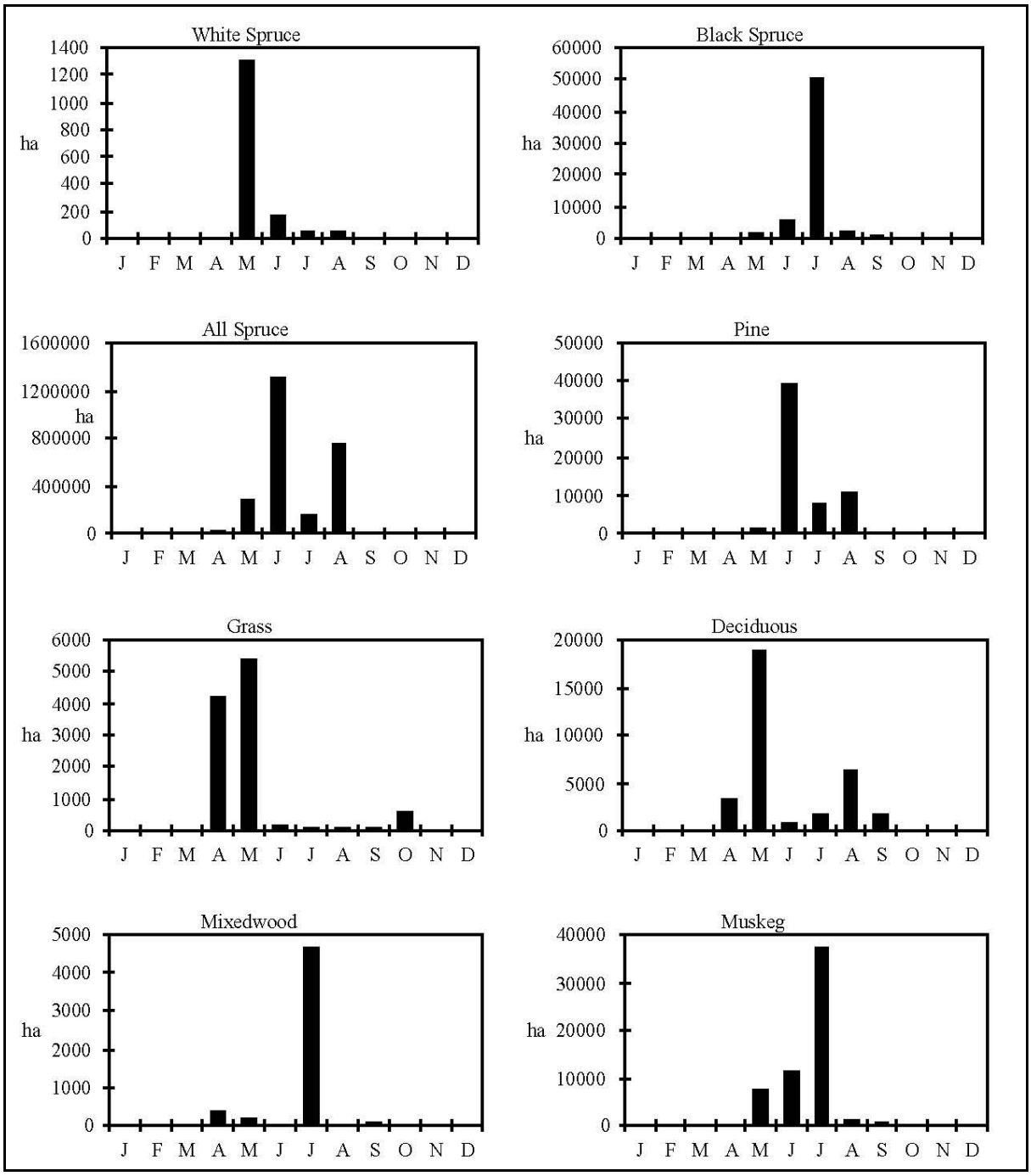


Figure 6.8 : Area burned by fuel type for each month (1983 to 1992)

Source : Biophysical document, p 5-40

Fire frequency peaked in July for spruce, mixedwood and muskeg cover types, in May for grass and deciduous fires and in June in pine communities. Area burned by fire peaked in July for black spruce, mixedwood and muskeg, whereas white spruce, grass and deciduous cover types peaked in May, and pine peaked in June. A bimodal pattern in area burned (May and August) occurred for deciduous forest communities. This pattern may reflect flammability of aspen-dominated stands during the spring period following snowmelt and prior to leaf flush and the early fall season as leaf senescence

occurs. Composition of fuel types (at point of fire origin) appeared to be an important determinant of average fire size.

6.2.5 Burn Probability

Table 6.5 shows that on average 191 fires burning a total area of 47,335 ha can be expected annually in the study area. With fire incidence and area burned being strongly seasonal with peak activity occurring in mid-summer (Table 6.2), the majority of the area burned can be expected during June and July. Using simple linear regression, the trendline in Figure 6.5 above suggests that the number of fires is increasing over time.

6.2.6 Recent Wildfires on the DFA

The location, number of starts and area affected by wildfires on the DFA over the four year period from 2003 to 2006 are shown in Table 6.6. While this is a relatively short period in fire regime history, it suggests that the combination of fire weather, increasingly refined detection and pre-suppression systems, and Alberta fire suppression managers are having some effect on preventing large wildfire events in the DFA. The spatial location of wildfires for the 2003-2009 period are shown in Figure 6.9.

Table 6.6 : Recent wildfires on the DFA (2003-2006)

FMU	Fire Year								Total	
	2003		2004		2005		2006			
	No of Fires	Area (ha)	No of Fires	Area (ha)	No of Fires	Area (ha)	No of Fires	Area (ha)	No of Fires	Area (ha)
FMA East										
F1			3	37.8					3	**37.8**
P4	2	0.5	4	7.1	3	2.1	4	5.9	13	**15.6**
P5			1	2.6	2	17.1			3	**19.7**
S15	2	7.0	12	127.6	5	15.9	1	1.9	20	**152.3**
Total	**4**	**7.5**	**20**	**175.2**	**10**	**34.9**	**5**	**7.8**	**39**	**225.4**
FMA West										
P10			4	8.0					4	**8.0**
P1N	1	1.4					2	8.0	3	**9.4**
P13	4	2.8	6	17.8	2	2.0	2	521.5	14	**544.1**
Total	**5**	**4.3**	**10**	**25.7**	**2**	**2.0**	**4**	**529.4**	**21**	**561.4**
Grand Total	**9**	**11.8**	**30**	**200.9**	**12**	**36.9**	**9**	**537.2**	**60**	**786.8**

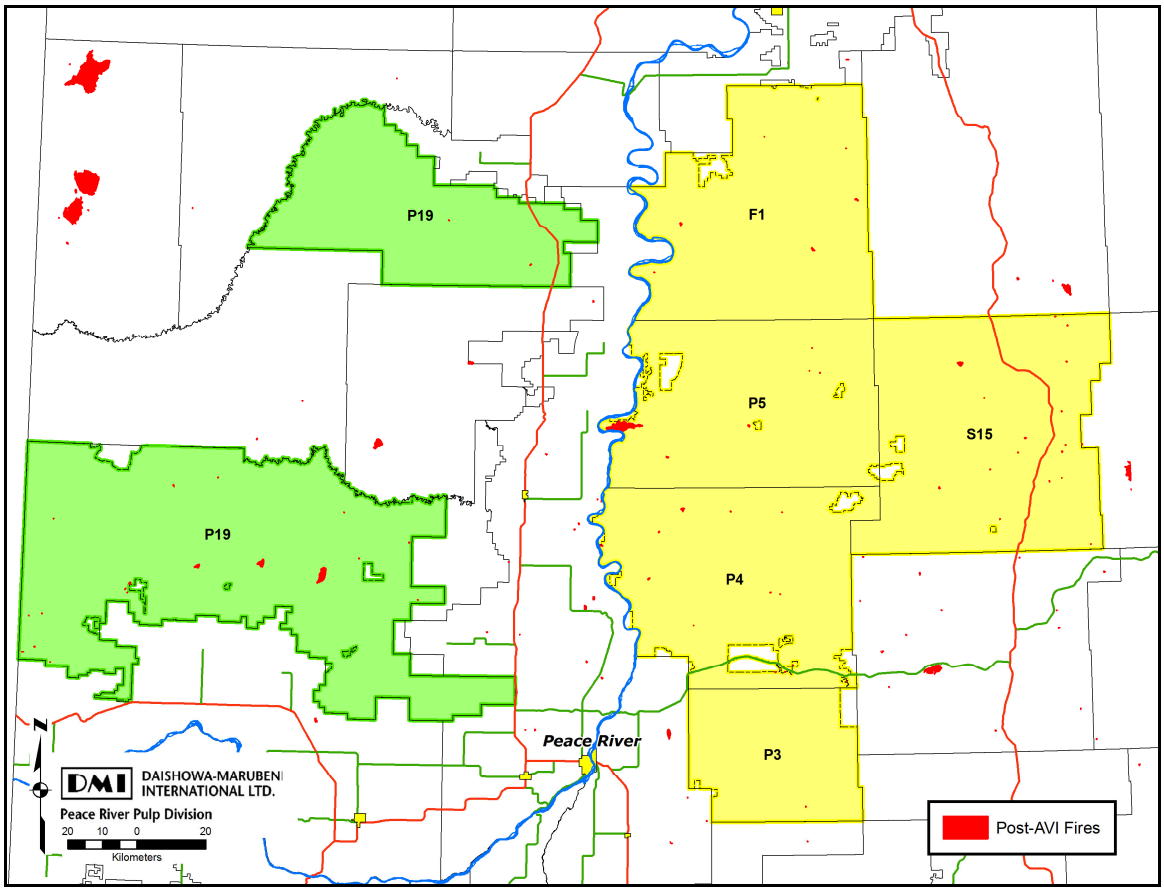


Figure 6.9 : Location of wildfires on the DFA for the period 2003 to 2009

7 Land Use

The FMAs represent an extensive track of land that provide a multitude of resources and benefits to Alberta. In line with principles of integrated land management, the public lands are available for multiple uses. From the forest industry business perspective, wood fibre is the critical resource, but there is a wide array of interests in the crown lands. Below is a description of some of the multiple uses of the FMA including timber, trapping, grazing, oil and gas, recreation, tourism, outfitting, cultural resources, historical resources, visual resources, fish and wildlife resources, government and protected areas and parks.

7.1 Timber

There exists a long history of logging in northwest Alberta, undoubtedly beginning with aboriginal people harvesting trees for subsistence purposes such as lodging materials and heating. In addition, aboriginal peoples often used prescribed fire as an effective tool for creating forest clearings that provided forage for the hoofed mammals they hunted. The arrival of the first Euro-Canadians, and the subsequent development of a fur trapping industry, lead to increased levels of logging to clear trails and road networks, for fuel wood, and to build residences and forts. The recognition in the early 1900's that the "Peace Country" had fertile soils lead to a large influx of home-steaders who deforested large tracts of boreal forests along the Peace River Valley for purposes of grain cultivation, hay crops, and livestock production.

The subsequent development of towns in northwest Alberta created a growing demand for the timber and dimension lumber needed to build residential and commercial buildings. This regional demand for lumber was met by several local sawtimber mills run by families or small businesses. Large national and multi-national companies first arrived in northwest Alberta in the 1960's. This new scale of forestry, and the significant levels of infrastructure, capital, and workforce required, as well as the large volumes of sawtimber and pulp produced, would require a structured and regulated approach to forestry based on the principles of sustainable forestry. These principles are described in Forest Management Agreements (FMA) signed between the forest company and the provincial government. As part of an economic development strategy for the boreal regions of Alberta, the Government of Alberta made several large allocations of timber or signed forest management agreements (FMA) in the 1970's, 1980's, and 1990's for the purpose of allocating an AAC (Annual Allowable Cut) that fully utilizes the available forest growth increment in a sustainable manner. Today, the forest sector is an important employer and contributes significantly to regional economies.

A transformation of the forest sector occurred in northwest Alberta in the late 1980's when emerging technologies allowed for the harvest and processing of hardwood species (primarily aspen) into pulp products. Whereas hardwoods were an insignificant contributor to harvest volumes prior to 1989, beginning with the commissioning of the Peace River pulp mill in 1989, they now account for over half of the total volume harvested.

In addition to DMI, other forest products companies have access to fibre on the FMAs through timber quotas including Canfor, Zavisha Sawmills, Tolko, Boucher Bros. Lumber Ltd., Buchanon Lumber Ltd., West Fraser-Seehta Forest Products and two numbered companies.

DMIs two FMA areas supply most of its fibre requirements for its pulp mill in Peace River. The Peace River pulp mill currently utilizes about 1,600,000 cubic metres of hardwood chips and 800,000 cubic metres of conifer chips each year. DMI also has Deciduous Timber Allocation (DTA) tenure on an additional 5.0 million hectares in the region.

Most energy sector activities involve the harvesting of forest resources, with seismic operations being the largest single contributor to forest harvesting. Linear oil and gas industry activities combined (i.e., roads and pipelines) resulted in a total deletion of 16,714 ha (10,620 ha on FMA East and 6,094 ha on FMA West) from the net landbase. By 2009, 64,116 km of seismic lines had been cut in the FMAs, resulting in 30-40,000 ha of area harvested (Not all km occur on productive upland forest).

7.2 Trapping

Subsistence trapping of fur-bearing species by First Nations communities for meat and furs likely dates back to the first appearance of aboriginal peoples. Commercial fur trapping has occurred in northwest Alberta since the earliest of North American explorers in the 1700's. The Hudson's Bay Company formalized the fur industry by establishing a network of forts (Vermilion, Dunvegan, Chipewyan, and St. John) and trading routes throughout the region based on the distribution of fur trapping by aboriginal people. The major aboriginal peoples of northwest Alberta who trapped furs and traded with the Hudson's Bay Company were the Cree, Beaver, and Sekani Indians.

Although fur trapping still occurs throughout northwest Alberta, the number of people who are dependent on this industry has declined during the last several decades. Today, few trappers rely on fur sales as their sole source of income.

Fur trapping is administered by Alberta Sustainable Resource Development. Trappers operate on licensed areas known as Registered Fur Management Areas (RFMA), with designated boundaries in which they can harvest furbearing species in accordance with the provincial trapping regulations.

There are approximately 1,700 RFMAs throughout Alberta, of which 176 are located on DMIs FMA areas as shown in Table 7.1.

Table 7.1 : Registered Fur Management Areas by FMA and FMU

FMU	No of RFMAs
FMA East	
F1	14
P3	16
P4	32
P5	19
S15	23
Total	**104**
FMA West	
P19 north	18
P19 south	54
Total	**72**
Total	**176**

Of the 18 commercially licensed fur-bearing animals that are trapped within Alberta, 14 are found within and around the DFA area (Figure 7.1). These are beaver, black bear, coyote, fisher, fox, lynx, marten, mink, muskrat, otter, squirrel, weasel, wolf and wolverine. Black bear is not trapped but can be shot by trappers. Based on export permits for the period July 1, 2007 to June 30, 2008[24], Wolverine and Lynx were the most valuable at over $270/pelt, with wolf averaging $166 and all other species below $100/pelt.

[24] Alberta Guide to Trapping Regulations. 2008 – 2009. Pub. No. 1/085. Alberta Sustainable Resource Development.

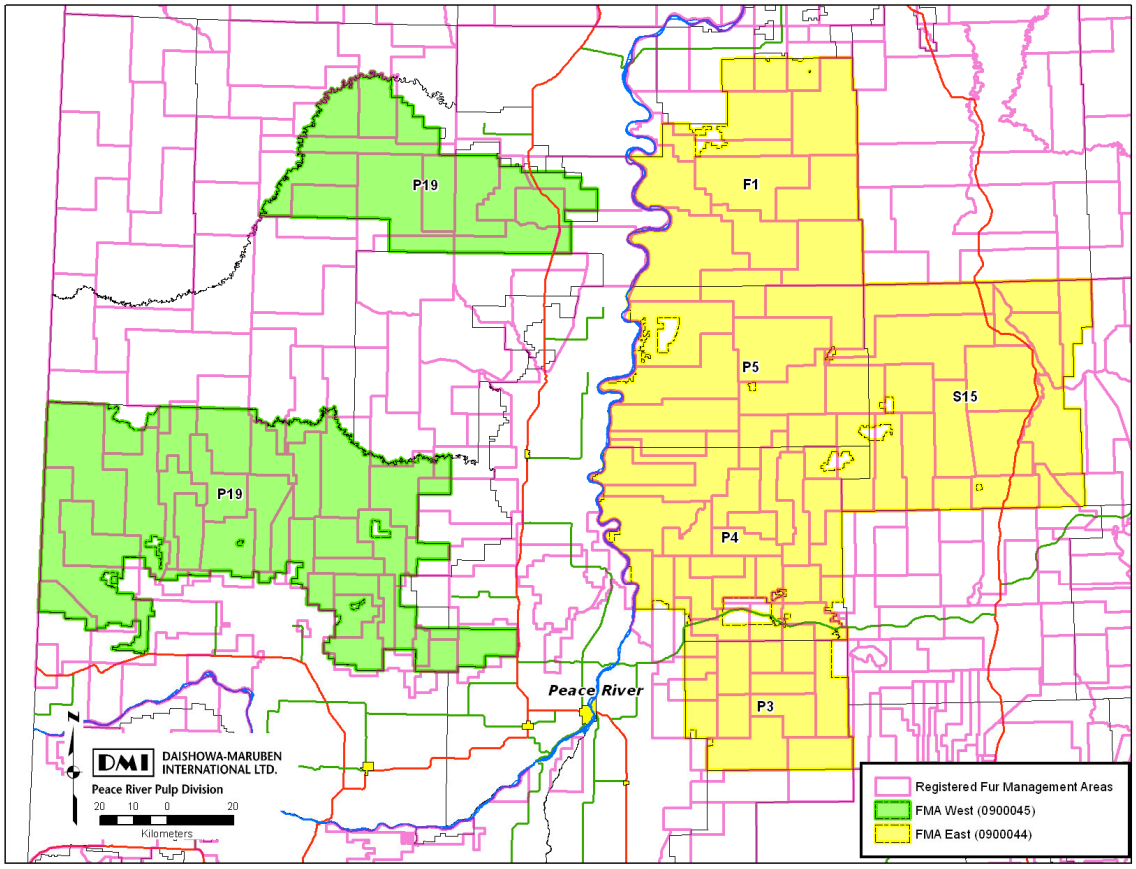


Figure 7.1 Registered Fur Management Areas on the DFA

7.3 Grazing

Grazing dispositions exist both in and around both FMA areas and include Forest Grazing Licenses (FRLs), Grazing Lease (GRLs), Grazing Permit (GRPs) and Provincial Grazing Reserves (GRRs). As shown in Table 7.2, the total area of the grazing dispositions within the FMAs is relatively small, making up approximately 0.002% of the total gross area. Figure 7.2 illustrates that the grazing dispositions that are within the FMA are only found along the FMA boundaries.

Table 7.2 : Areas allocated to grazing dispositions

FMU	Within FMA	Not part of FMA	Total
	Ha	Ha	Ha
Eastside FMA			
F1			
P3	962.03	545.34	1,507.37
P4	0.08	1,745.65	1,745.73
P5			
S15			
Total	**962.11**	**2,290.99**	**3,253.10**
Westside FMA			
P19 (north)			
P19 (south)	193.41	1,876.71	2,070.13
Total	**193.41**	**1,876.72**	**2,070.13**
Total	**1155.52**	**4,167.72**	**5,323.24**

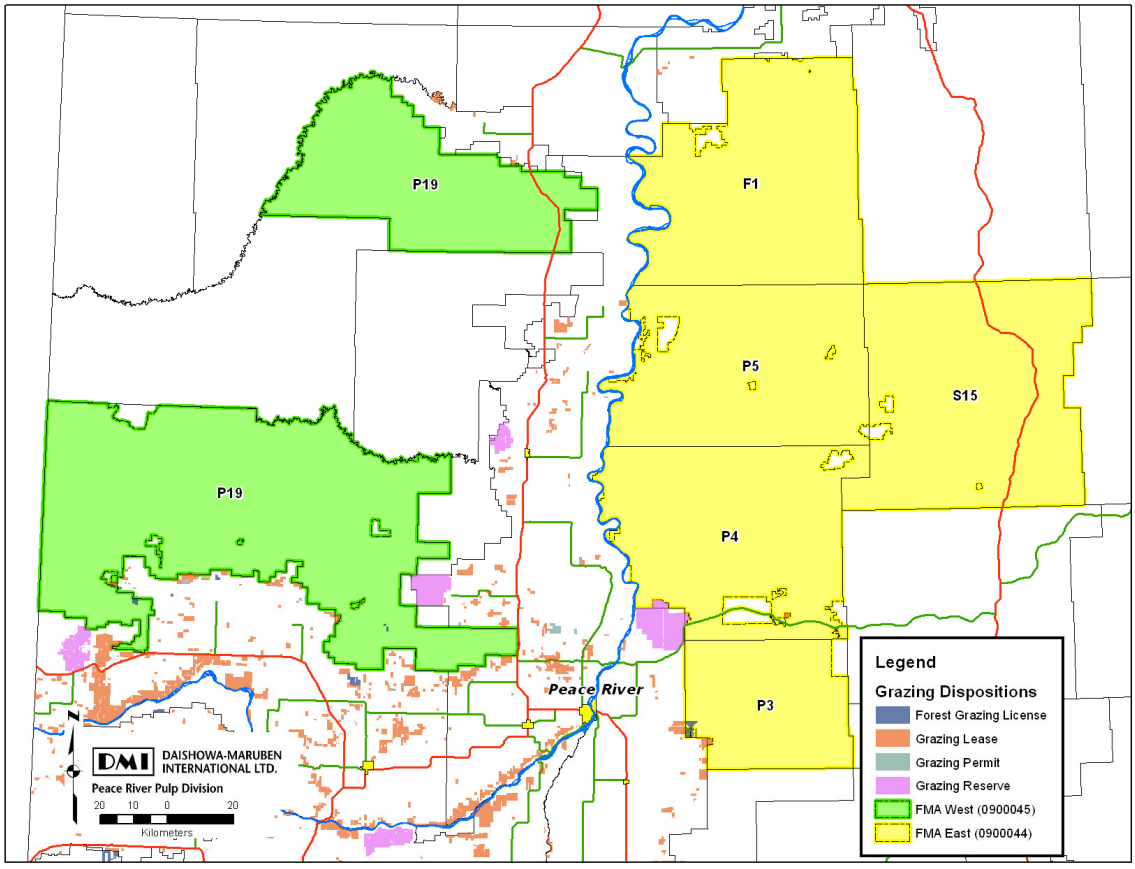


Figure 7.2 : Location of grazing dispositions on the DFA

7.4 Oil and Gas Industry

Much of Alberta, including the northwest region, is underlain with rich oil, oil sands, and natural gas. The petrochemicals found in these reserves are the largest single contributor to Alberta's economy and standard of living. The energy sector is also an important employer of the work force of northwest Alberta and provides the fuel base for such activities as public transportation, agriculture, forestry, and mining. These socio-economic factors have contributed to the region's development but have left a geographical footprint on the boreal forest landscape with significant implications to forest management and ecological integrity (Figure 7.3).

Annual natural gas production has increased consistently since the mid-1950's. The size of known gas reserves increased from 1956 to 1982 as the discovery of new fields exceeded rates of extraction. Since 1982 gas reserve volumes have declined consistently as extraction rates exceeded new field discoveries. Remaining reserves are crudely projected to be economically exhausted by year 2040, however this does not consider the projected emergence of coal bed methane as a replacement for the declining resource.

Oil extraction volumes increased sharply from 1956 to 1973, fell sharply from 1973 to 1976, and thereafter stabilized. Established crude oil reserves increased sharply from 1956 to 1969 and have fallen precipitously from 1969 to 1997, as extraction exceeded the discovery of new reserves. It is estimated that oil reserves are likely to be economically exhausted by the year 2010.

Extraction of oil sands in northeast Alberta has increased consistently from 1967 to an annual rate of ~200 million tonnes in 1997. Oil sands production has yielded a cumulative 3 billion tonnes between 1967 and 1997, or less than 1% of the estimated total provincial reserve of ~ 1.7 trillion tonnes. Current projections estimate that oil sand extraction is likely sustainable until the year 2300. Approximately half of the known reserves are thought to be economically attractive, and of that only 15% of the volumes are likely recoverable using existing extraction and processing technologies. An estimated 5 billion m^3 exists as mineable surface deposits, and these are confined largely to the region that includes the Syncrude and Suncor leases of northeast Alberta. Most of the remaining oil sand reserves, including those deposits known to exist in northwestern Alberta, are deep "in situ" deposits and are likely to be extracted using steam injection or similar technologies.

The focus of oil sands production over the past 30 years has been centered on surface mining operations in northeastern Alberta, while the deep subsurface oil sand deposits of northwestern Alberta have remained relatively undeveloped. The development of steam injection technologies during the past decade, however, has made it feasible to exploit subsurface oil sand deposits. Shell Canada is currently using steam injection technology to extract oil sand deposits at their operation northeast of Peace River.

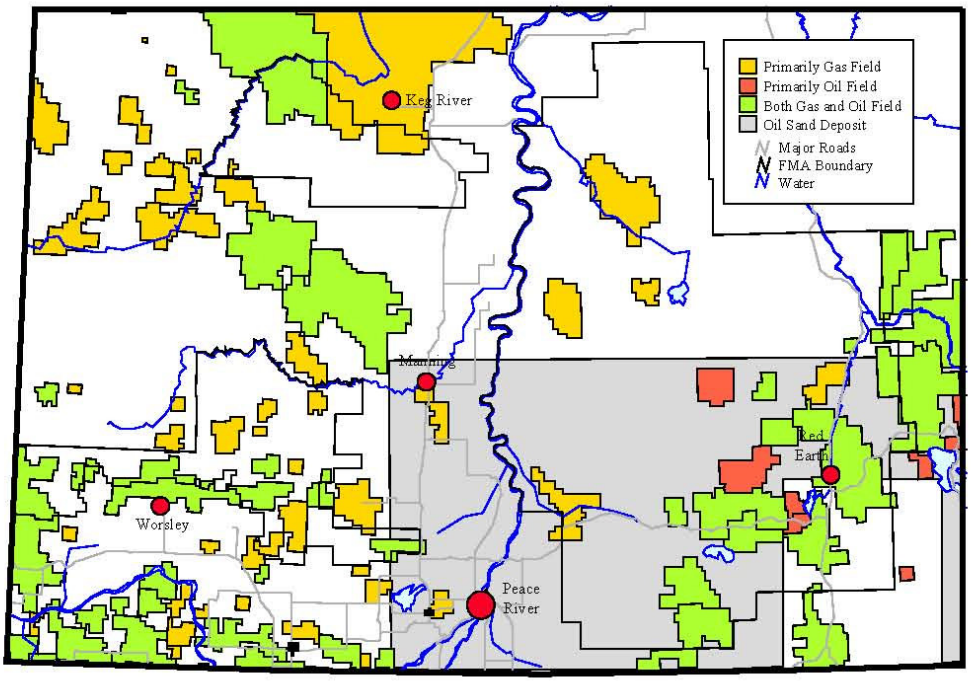


Figure 7.3 : Known oil, gas and oilsand deposits in the DFA area

7.5 Recreation

Many opportunities for recreational activity exist within and the region and around the DFA. While a number of campgrounds and other areas are designated for recreational purposes, the public is free to pursue recreational activities anywhere on the DFA as it is crown land. Some of the most common types of recreational activities pursued in this area include camping, hunting, fishing, hiking, riding all terrain vehicles (ATVs), horseback riding, snowmobiling, cross country skiing and wildlife viewing. In recent years organized development of ATV trail events and planning for trail networks (skidoo clubs) appears to be increasing in response to tremendous growth in off-highway vehicle registrations within Alberta.

7.6 Tourism

The FMAs are open to public use and as such provide considerable opportunities for activities sought out by tourists. Camping, hunting, hiking and snowmobiling are examples that draw tourists to the area. In the larger surrounding area, there are a wide range of tourism tourism opportunities and/or facilities including several ski hills (e.g. Misery Mountain, Worsely), golf courses, provincial parks (e.g. Winogami Provincial Park, Queen Elizabeth Provincial Park, Figure Eight Provincial Park, etc.) and a wide range of trail systems extending throughout the provincial areas situated around the FMA area.

More information on the tourism opportunities can be found at the following web sites:

- Peace River Chamber of Commerce
- Discover the Peace
- http://www.albertatourism.com/ab/home.do

7.7 Outfitting

We provide black bear hunts, moose hunts, elk hunts, whitetail deer, mule deer hunts and waterfowl hunts including duck hunting and goose hunting in a prime Alberta Hunting area.

7.7.1 Hunting

Sport hunting is a popular activity in north western Alberta, and contributes significantly to the regional economy. Sport hunting is administered by Alberta Sustainable Resource Development. Annual details pertaining to sport hunting are provided in the Alberta Guide to Hunting Regulations. Regulations pertaining to sport hunting are administered geographically at the scale of the Wildlife Management Unit (WMU). The FMUs fall within the WMUs as shown in Table 7.3.

Table 7.3 : Wildlife Management Units (WMUs) in the FMAs

WMU Number and Name	FMU	Species Hunted
520 Cadotte Lakes-Otter Lakes	FMA East - P3, P4, S15	White-tailed Deer, Mule Deer, Moose, Elk, Black Bear
523 Kimiwan-Winagami Lakes	FMA East - P3, P4	White-tailed Deer, Mule Deer, Moose, Elk, Black Bear
524 Chinchaga River	FMA West – P19	White-tailed Deer, Mule Deer, Moose, Black Bear
525 Clear Hills	FMA West – P19 south	White-tailed Deer, Mule Deer, Moose, Elk, Black Bear
526 Upper Peace River	FMA West – P19 south	White-tailed Deer, Mule Deer, Moose, Elk, Black Bear
527 Whitemud-Hotchkiss Rivers	FMA West – P19 south	White-tailed Deer, Mule Deer, Moose, Elk, Black Bear
528 Buffalo Head Hills	FMA East – F1, P5, S15	White-tailed Deer, Mule Deer, Moose, Black Bear
537 Naylor Hills-Hawk Hills	FMA West – P19 north	White-tailed Deer, Mule Deer, Moose, Black Bear
541 Panny River	FMA East – S15	White-tailed Deer, Mule Deer, Moose, Black Bear
544 Utikuma Lake	FMA East – P3	White-tailed Deer, Mule Deer, Moose, Black Bear

Most of the DFA falls within WMUs 520 and 528 in the east and 525, 524 and 537 in the west. White-tailed deer, mule deer, moose and black bear can be hunted within the any of the WMUs during the hunting seasons specified in the hunting regulations. Elk can only be hunted in WMUs 520, 523, 525, 526 and 527 (Figure 7.4).

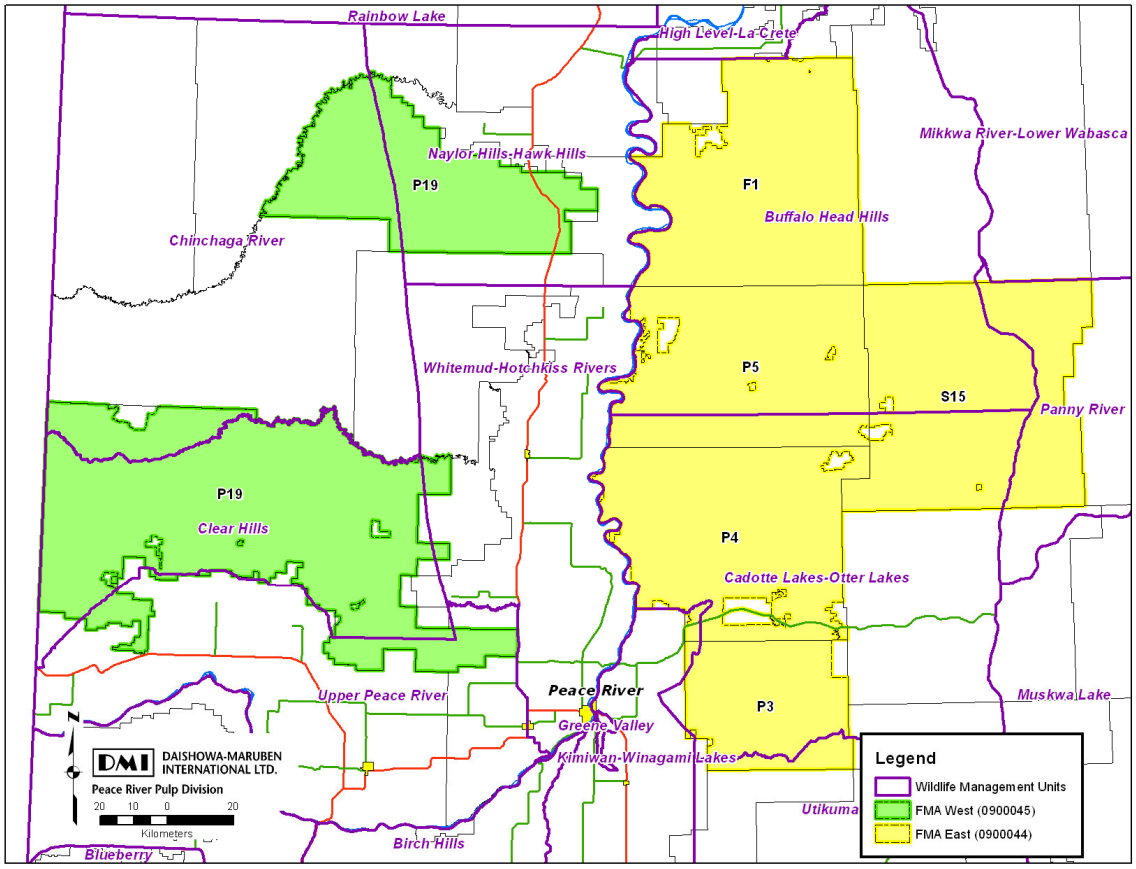


Figure 7.4 Wildlife Management Units occurring within the FMAs.

7.7.2 Fishing

The DFA lies within watershed unit 3 (NB3) of Fish Management Zone 3 (Northern Boreal Zone). Sport fishing is administered by Alberta Sustainable Resource Development. Annual details pertaining to sport fishing are provided in the Alberta Guide to Sportfishing Regulations. The region contains diverse eco-regions ranging from foothills to sub-Arctic and a wide diversity of fish species and habitats. Larger lakes in the region support commercial, sport and domestic fisheries for lake whitefish, walleye, pike, and perch. Commercial fishing is practised on a few of the larger lakes in northwest Alberta, with Lake whitefish, pike, walleye, perch and lake trout also being part of the catch. However, there is no commercial fishing that occurs within the FMAs.

7.8 Cultural and Historic Resources

The Historical Resources Act empowers the Minister of Culture and Community Spirit to designate any site as a Provincial Historic Resource, if its preservation is in the public interest. Alberta's Historic Places Designation Program administers the process of designating sites as Provincial Historic Resources. Designation serves to recognize the significance of historic places and provide them with the protection necessary to ensure

their preservation. It also makes site owners eligible for grants from the Alberta Historical Resources Foundation for conservation work[25].

The *Listing of Historic Resources*[26] identifies lands that contain or are believed to contain historic resources, including primarily archaeological and palaeontological sites, Aboriginal traditional use sites of a historic resource nature, and historic structures. Currently, there are almost 300 sites protected as Provincial Historic Resources in Alberta.

The information assembled on historic sites has been used by Alberta Culture and Community Spirit, in conjunction with the Alberta Energy and Utilities Board, to assist in the evaluation of the impact of development proposals by the energy sector (primarily well sites). Those sites which are considered to be the most important are listed as Significant Historical Sites, and are assigned an appropriate "historical resource value" (HRV). The list, however, contains only a small percentage of the total number of historical sites and areas that have been identified (Figure 7.5).

Each section of land listed has been assigned an HRV ranging from 1 to 5. The highest level of protection (HRV 1) is afforded to lands that have been designated under the Act as Provincial Historic Resources. The HRVs are defined as follows:

- HRV 1 : designated under the Historical Resources Act as a Provincial Historic Resource or a World Heritage Site.
- HRV 2 : designated under the Historical Resources Act as a Municipal or Registered Historic Resource.
- HRV 3 : contains a significant historic resource that will likely require avoidance
- HRV 4 : contains a historic resource that may require avoidance
- HRV 5 : believed to contain a historic resource

Each entry in the Listing is then itemized as to its primary historic resource category of concern, as follows:

a	archaeological
c	cultural
gl	geological
h	historic period
n	natural
p	palaeontological

A total of 222 designated historic sites currently exsist on the DFA (Table 7.4), of which four (4) fall within HRV 3 and fifteen (15) are in HRV 4. The remainder are HRV 5s and believed to contain either an archaeological or palaeontological historic resource.

[25] Source : http://culture.alberta.ca/heritage/resourcemanagement/historicplacesstewardship/designation/historic_places.aspx

[26] Listing of Historic Resources. Instructions for Use. Alberta Culture and Community Spirit.

http://culture.alberta.ca/heritage/resourcemanagement/landuseplanning/default.aspx

Table 7.4 : Number of designated historic sites on the DFA by HRV and category

FMU	Historic Resource Value and Category				Total
	3 h	4 a	5 a	5 p	
FMA East					
F1				20	20
P3		2	1		3
P4	2	10	2	51	65
P5	2	2	4	9	17
S15				18	18
Total	**4**	**14**	**7**	**98**	**123**
FMA West					
P19 north					
P19 south		1	1	97	99
Total		**1**	**1**	**97**	**99**
Total	**4**	**15**	**8**	**195**	**222**

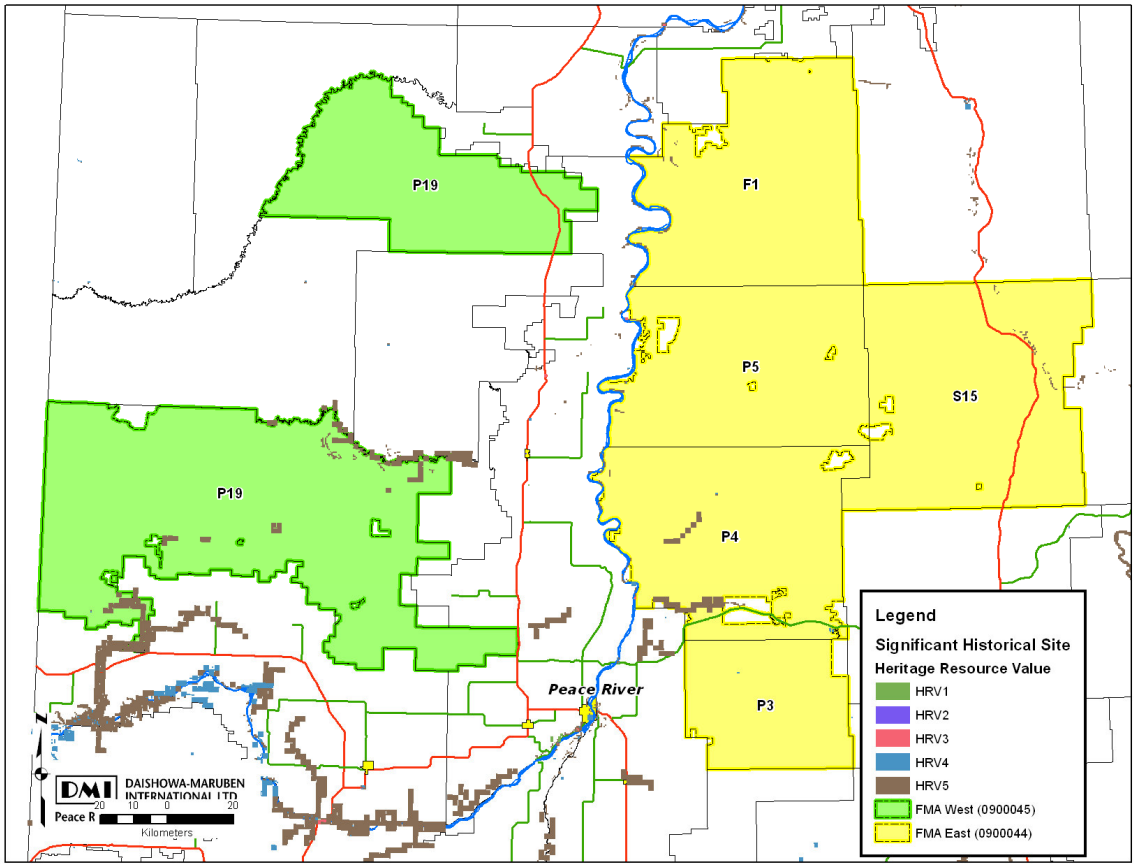


Figure 7.5 General location of significant historical sites and their associated heritage resource value.

7.9 Visual Resources

The Peace River area and DMI's FMAs are blessed with natural formations and forests that make the area visually appealing throughout the year. The major visual resources include the Peace River Valley and the breaks around it and all of its significant tributaries and the hills found throughout the FMA including Clear Hills on the Westside FMA and Buffalo Head Hills on the Eastside FMA (Figure 7.6). A standard formation around larger rivers are breaks, which in the case of the Peace River, drop close to 1000 feet to the water. These areas have been voluntarily removed from the landbase to eliminate the opportunity for operations on them, thereby ensuring the continuation of the beautiful vistas from the river valleys. Harvest operations have been modified from the previous two-pass approach where quilt patterns of cuts were left across the landscape to ecologically-based forest management practices that utilize variable-retention and natural irregular block shapes, thereby minimizing line of site and maintaining a "natural" look on the landscape.

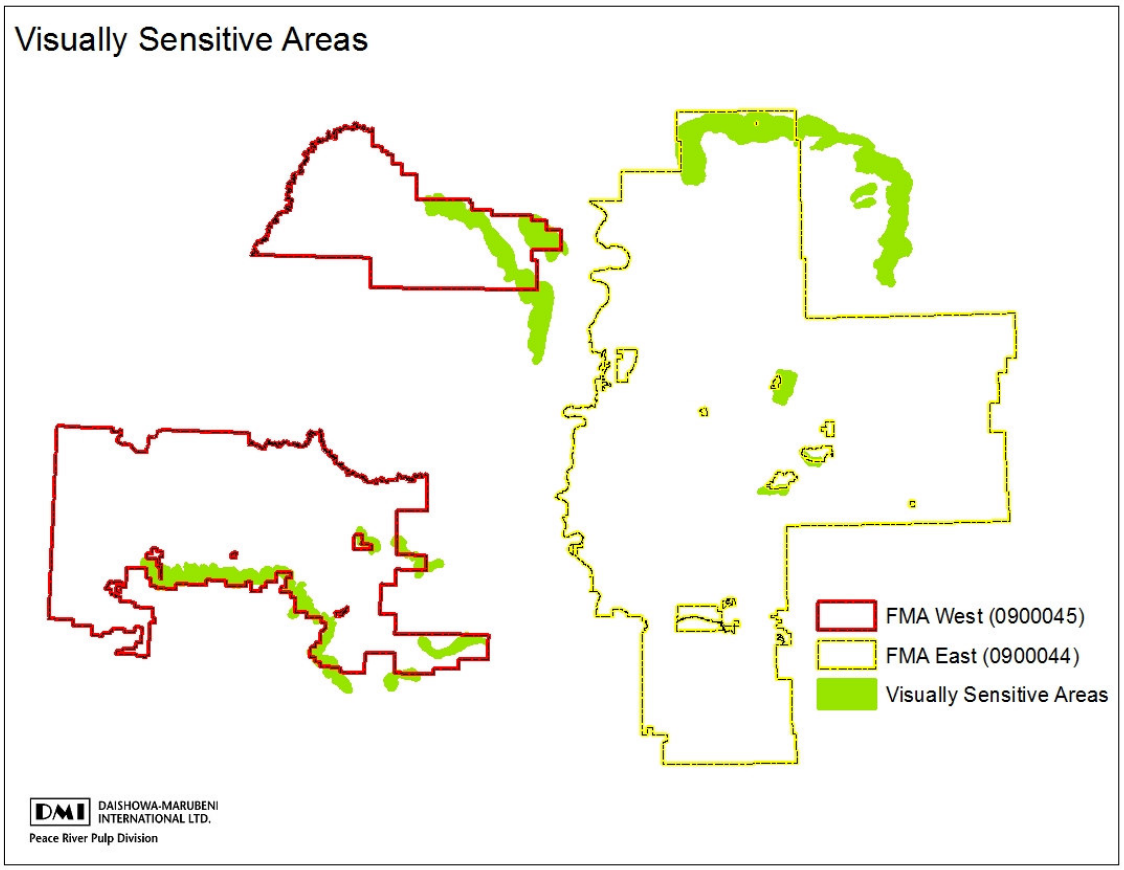


Figure 7.6 Visually sensitive sites in and near the FMAs.

7.10 Fish and Wildlife Resources

The right and responsibility to maintain and enhance fish and wildlife resources is retained by Alberta as reflected in the Forest Management Agreement, natural resource

legislation and by policy directive[27]. This includes the inventory and monitoring of species populations, as well as the description of wildlife habitat. It is clarified that the forest industry has participatory roles in maintaining wildlife habitat, identifying watercourses, and assisting the identification of fish bearing watercourses.

DMI's management strategy is intended to be inclusive and will accommodate the full suite of biota and ecological processes on its tenured landscape by recognizing that forestry practices should not advantage certain species of biota at the expense of others. At the same time, DMI recognizes that certain species of wildlife enjoy elevated status by Albertans because of their importance to:

- subsistence and recreational uses (e.g., moose, elk, deer, game birds, fisheries),
- the fur industry (e.g., Red Squirrel, Marten, Canada Lynx, Snowshoe Hare, Wolverine, Gray Wolf, Fisher, Mink, Weasel, Muskrat, Coyote),
- or because their populations have been threatened by cumulative human activities (e.g., Trumpeter Swans, Woodland Caribou, Grizzly Bear, Wood Bison, Common Nighthawk, Canada Warbler, Olive-side Flycatcher, Loggerhead Shrike, Haller's Apple Moss).

The Province's Land Management Referral Maps provide spatial delineation of polygonal or point habitat features associated with particular "species of management concern" that are designated by Alberta. Within northwest Alberta, they include portions of landscape associated with habitat for; Colonial nesting birds (e.g., American White Pelican), Grizzly bear, Sharp-tailed Grouse, Woodland Caribou, Trumpeter Swans, Key Wildlife Biodiversity Zones (formerly 'winter ungulate zones') and Special Access Zones (upland ungulate habitat). To 2010 no land management policies exist for the grizzly bear zone overlapping the west-FMA, and only sporadic spatial data exists on northwest Alberta snake hibernacula (e.g., Wandering and Red-sided Garter Snakes), Northern Long-eared Bats, at-risk plants, and sensitive amphibian features (e.g., Boreal Toad, Canadian Toad, Long-toed Salamander). Similarly, Alberta spatial data on sensitive fisheries (e.g., Arctic Grayling, Bull Trout) are yet evolving as are localized conservation policy guidelines for adjacent land practices. A number of song bird (e.g., Black-throated Green Warbler) and other avian species (e.g., eagle species, Barred Owl, Pileated Woodpecker, Osprey, Northern Goshawk, specific Grebe and Tern species, Peregrine Falcons, Short-eared Owl) are beginning to gain regulatory mention in protective legislation on Migratory Birds and/or at-risk species.[28]

In 2010, DMI and Royal Dutch Shell commissioned Dr. Stelfox (ALCES) to conduct an up-dated cumulative effects assessment[29] on local landscapes in order to project ranges of anticipated future activity of the forestry and hydrocarbon sectors. The assessment included some discussion and scenario analyses of performance indicators for ecological integrity and Wildlife Habitat Utility (e.g. native landscape fraction, edge density, core area, patch density, old forest, wetland, and habitat for a variety of wildlife species; Canadian Toad, Wolverine, Long-eared Bat, Moose, Fisher, Caribou, native

[27] February 2010 Alberta Directive –Forest Tenure Roles and Responsibilities in Alberta

[28] Alberta Upstream Oil and Gas Best Management Guidelines for the Enhanced Approval Process., and Alberta Timber Harvest Planning and Operating Ground Rules.

[29] An Assessment of the Cumulative Effects of Landuses in Northwest Alberta. ALCES Landscape and Land-Use Ltd. (the ALCES Group). February 2010. 53pp.

fish, old-forest birds, black bear). To ensure continuity with Alberta government-endorsed projects examining cumulative effects of landuses on the boreal forest, ecological indicators used in the CEMA SEWG (Cumulative Effects Management Association; Sustainable Ecosystems Working Group) initiative of northeast Alberta were applied to the Stelfox ALCES assessment. This assessment included some discussion of the baseline Natural Range of Variability (NRV) for each of the ecological indicators.

7.10.1 Defining Boreal Species Diversity (Baseline)

DMI acknowledges the public value placed on maintaining the diversity of species occupying its tenured landscapes and the importance in developing appropriate forest management activities that consider forest dependent biota. Consequently the company recognizes the importance of striving toward persistence of the full range of biological diversity supported by local forests, as science continually reveals the extent of that diversity. Historically, no complete inventory has existed for northwest Alberta.

The first step in managing for biodiversity maintenance is to account for an awareness of the extent of that diversity. DMI continually reviews and up-dates an inventory list describing the diversity of forest flora and fauna believed to be occupying local forest landscapes. This work builds upon the initial comprehensive summary of "Biota and Ecological Communities" prepared as part of its 1999 *Biophysical* assessment[30] and the earlier DMI investigations into species diversity completed in 1993[31] and 1997[32] which collectively described species known or with potential to occur in northwest Alberta. Despite the rich species diversity already evident in the current DMI list[33], the company recognizes that this compilation is largely incomplete due to evolving northern boreal datasets and therefore considers it a work-in-progress. A variety of research including the EMEND suite of projects, has been further improving understanding and contributing to defining local boreal species diversity (particularly the invertebrate communities) over the past decade. DMI will continually improve and affirm this data-set as regional information grows through various sources.

In 2007, DMI's forest biota list suggested a local diversity of approximately 2149 documented species including plant kingdom, higher order taxa (mammals, fish, avifauna, herptiles) and invertebrates. That inventory was further improved in 2010 to just over 2500 species. Table 7.5 provides an illustration of this growth in knowledge. Figure 7.7 illustrates the proportionate diversity by biotic group.

Table 7.5 : Taxonomic Summary of Species Diversity –Northwest Alberta

Biotic Group	1999 DFMP Total Species	2007 DFMP Revision	2009 Up-date	**2010 Total**

[30] 1999 DMI DFMP, Stelfox/Wynes -A Physical, Biological and Land-Use Synopsis of the Boreal Forest's Natural Regions of Northwest Alberta, (see Chapter 3, 204 pgs)

[31] "Habitat Requirements for 177 Forest Dwelling Wildlife Species on the DMI FMA" (DMI and Alberta Fish & Wildlife)

[32] "Cooperative Fisheries Inventory Program –NW Boreal" -11 species (DMI, Canada Dept of Fisheries and Oceans, Alberta Fish & Wildlife, and energy sector partners) AND "Review of Endangered and Other Species of Concern in Northwestern Alberta" -292 species (59 of special status) –URSUS Ecosystem Management Ltd.

[33] DMI posts its current list of northern boreal species on its website (within the section on Landscape Assessment): http://www.dmi.ca/about_dmi/dmi_in_alberta/prpd/detailed_forest_management_plans.html

	Presented	Total	Total	**Species**
Vascular Plants & Ferns	506	541	541	**541**
Non-vascular: Mosses + Liverworts	119	178	178	**178**
Non-vascular: Lichens	119	128	128	**128**
Fungi	N/A	N/A	43	**43**
Birds	239	247	247	**247**
Mammals	46	47	47	**47**
Fishes (game and forage species)	34	35	35	**35**
Herptiles (amphibians and reptiles)	9	10	10	**10**
Arthropods	N/A	963	1014	**1271**
Gastropods and similar	N/A	N/A	12	**16**
Total	1072	2149	2255	**2516**

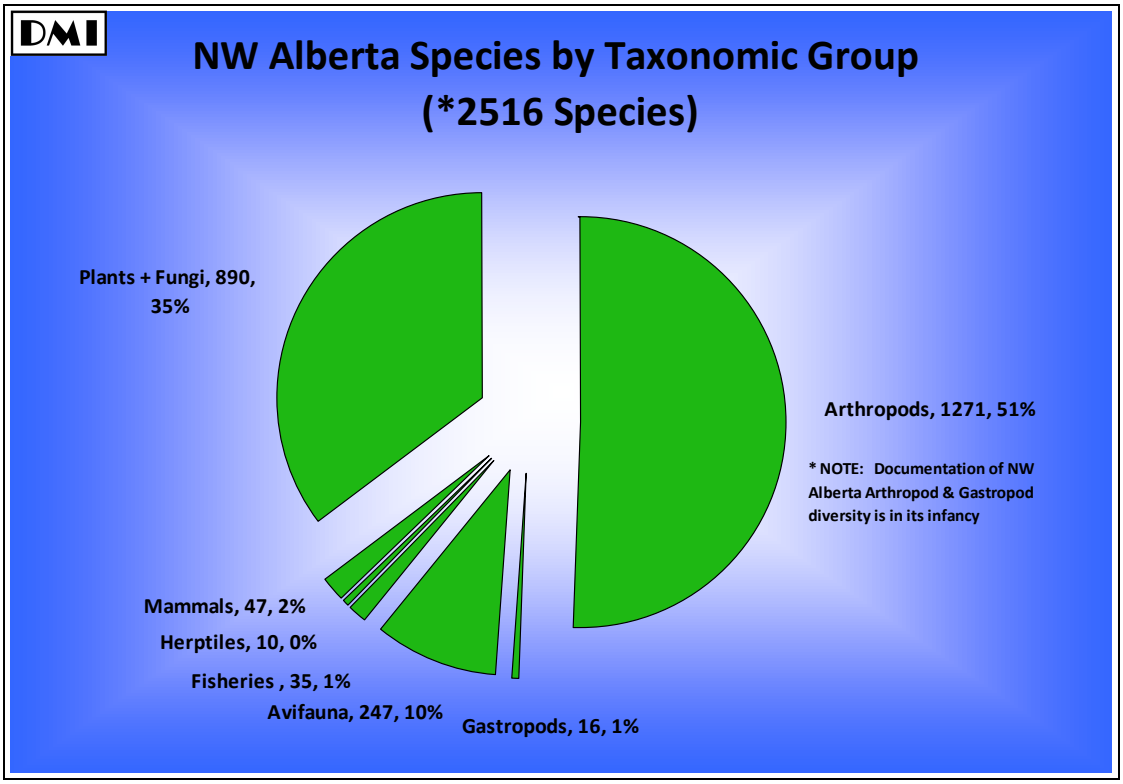


Figure 7.7 : Species Diversity in Northwest Alberta –Proportional Richness

At this time, DMI's growing inventory list contains 1287 invertebrates (1271 arthropods, 16 gastropods). Yet those taxa are far from complete considering the potential 22,000 species of arthropods that Stelfox cited are suspected to exist in Canada's boreal forests. They remain largely undescribed despite their ecological importance to boreal ecosystem functions and productivity (e.g., pollination, decomposition, nutrient cycling, predation, and forage for other species). The company did not have an invertebrate list

specific to the company's northwest Alberta tenure in the 1999 DFMP nor previous plan submissions.

DMI's current taxonomic baseline for species diversity reflects the benefit of annually growing information on locally occurring species that is directly arising through local research project observations (EMEND), various newly published sources and DMI staff observations. The EMEND forest research program in particular has notably been a source of new species discoveries and new records for Canada.

Considering the broad range of species that form local ecosystems, and the interactive roles of government and industry regarding species and habitat, DMI has deliberately elected not to approach its role in biodiversity conservation independently. The company remains directly and actively involved in a variety of research partnerships themed on improved understanding of ecosystem function. This effort has assisted to confirm local biodiversity profile as well as species responses to forest practices.

Further detailed analyses and discussion of the biotic communities within northwest Alberta is contained within the 1999 *Biophysical* document.

7.10.2 Defining Special Interest Species

A fundamental expectation in the management of publicly owned tenure is that natural resource professionals be aware of special interest species likely to occur in areas influenced by industrial activities they supervise. This does not imply a need for expertise in managing such species populations directly, but rather a good working knowledge of their vulnerabilities and management practices that mitigate or prevent impacts. Periodic consultation with expertise in applied biology or researchers involved with such species is necessary. The first step however is to account for an awareness of which special interest species occur locally. DMI continually reviews and up-dates an inventory list of such species, building upon initial work the company commissioned in the 1990's.

In 1993 the company participated in an initial project that produced a list of species and preliminary literature search for a collection that included a mix of sensitive and stable species.[34] That effort was followed by additional work in 1997 and 1998 when DMI consulted biology specialists in an exercise to identify or define the local collection of special interest species in advance of the 1999 forest management plan. The specific focus then was to develop an initial high-risk species list, addressing fish, plant and vertebrate species separately:

- "Review of Endangered and Other Species of Concern in Northwestern Alberta"[35]
  -This project focused on producing a vertebrate species list and synthesis of state-of-knowledge concerning the ecology, habitat and legal status of 59 species (from among 292 species) that were considered to be at various levels of higher sensitivity or risk at that time (COSEWIC and Alberta sources). While not directly described, forest management implications and mitigation opportunities were implied in the information presented for some of the species. Understandably for the time,

[34] 1993, DMI and Alberta Fish & Wildlife, "Habitat Requirements for 177 Forest Dwelling Wildlife Species on the DMI FMA"

[35] September 1997, Ursus Ecosystem Management Ltd., Douglas M. Collister (for Wynes, DMI, PRPD)

science-based information was presented in broad context rather than knowledge specific to the Peace River boreal region.

- "Habitat Requirements of Special Status Fish Species in the Peace River Area"[36] –This project provided similar purpose and information as the above project, but only for three species of fish, again based on state-of-knowledge to 1997 (Arctic Grayling, Bull Trout, Shortjaw Cisco).
- "Ecological Information –Rare Plants –Daishowa Marubeni International's Area of Interest"[37] -This project provided a list and literature on rare vascular and non-vascular plants, habitat associations and sensitivity ratings for 119 species known or with potential to occur locally.

Since those initial efforts, DMI continually endeavours to identify which current special interest species are relevant in this region, as those lists change or grow. The company's current approach now includes two general categories of species defined by different external sources: 1. Higher sensitivity species (including at-risk species) generally designated as-such by regulatory and scientific organizations through their formal assessment and consultation processes. 2. Other species of interest identified through a variety of local sources including public advisory groups, Aboriginal communities and various stakeholder consultations. These latter ones are not necessarily sensitive species, but may hold special significance because of their recreational, aesthetic, game or commercial market value (i.e. fur species). Figure 7.8 illustrates a general hierarchy among the various sources defining boreal species inventories and special interest species (e.g., scientific, public and government policy).

[36] June 1997, Stanley Environmental (Stanley Consulting Group Ltd.), Bob Shelast (for Wynes, DMI, PRPD)

[37] March 1998, Cottonwood Consultants Ltd., Cliff Wallis

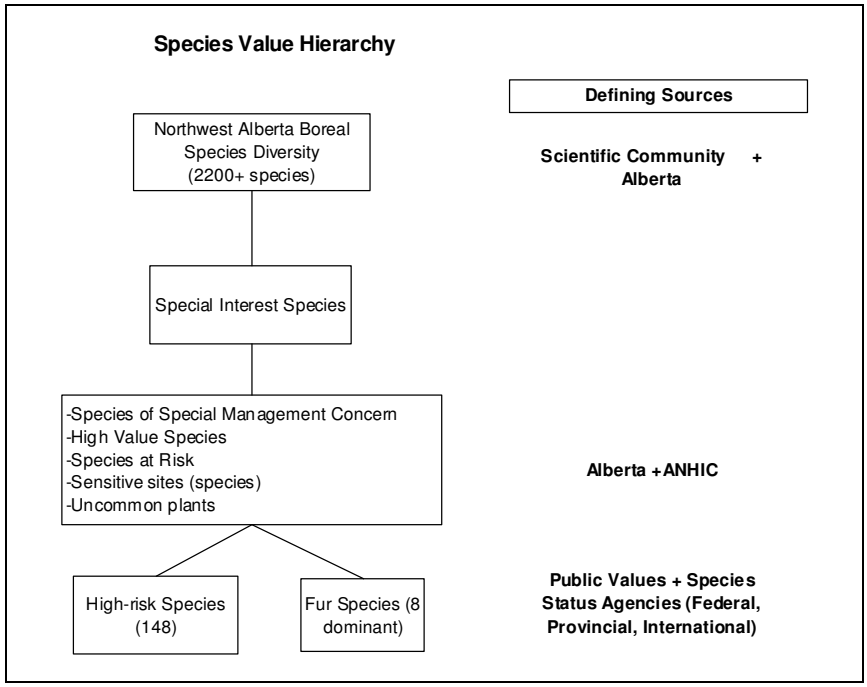


Figure 7.8 : Defining Sources for Special Interest Species

In the consideration of a broader set of species beyond those designated as "at-risk", the company coined the term "high-risk species" for internal purposes. DMI defines high-risk species as those that are assessed by a collection of external organizations as any of the following ratings: endangered or threatened (at-risk), may-be-at-risk, sensitive, vulnerable, special concern or rare (S1/S2). In order to determine which local species fit this definition, the company regularly consults a number of external agencies who issue species-status reports periodically. These include status-ratings defined at provincial (Wildlife Act, ACIMS, Alberta Status of Wild Species), national (SARA, COSEWIC) and international (IUCN) scales.[38] Awareness of these ranging scales of biodiversity status assessment is relevant today because of the global nature of the forest products marketplace, tenure holder obligations in managing landscapes under nationally-prescribed CCFM criteria, the international reach of social licence, and the maintenance of forest-products certifications. Figure 7.9 illustrates the three (3) species-status categories[39] DMI defined using grouped rankings of various organizations.

[38] ACIMS –Alberta Conservation Information Management System (formerly ANHIC –Alberta Natural Heritage Information Centre), SARA –Species at Risk Act, COSEWIC –Committee on the Status of Endangered Wildlife in Canada, IUCN –International Union for Conservation of Nature

[39] From DMI 2008 species status review project: Fiera Biological Consulting

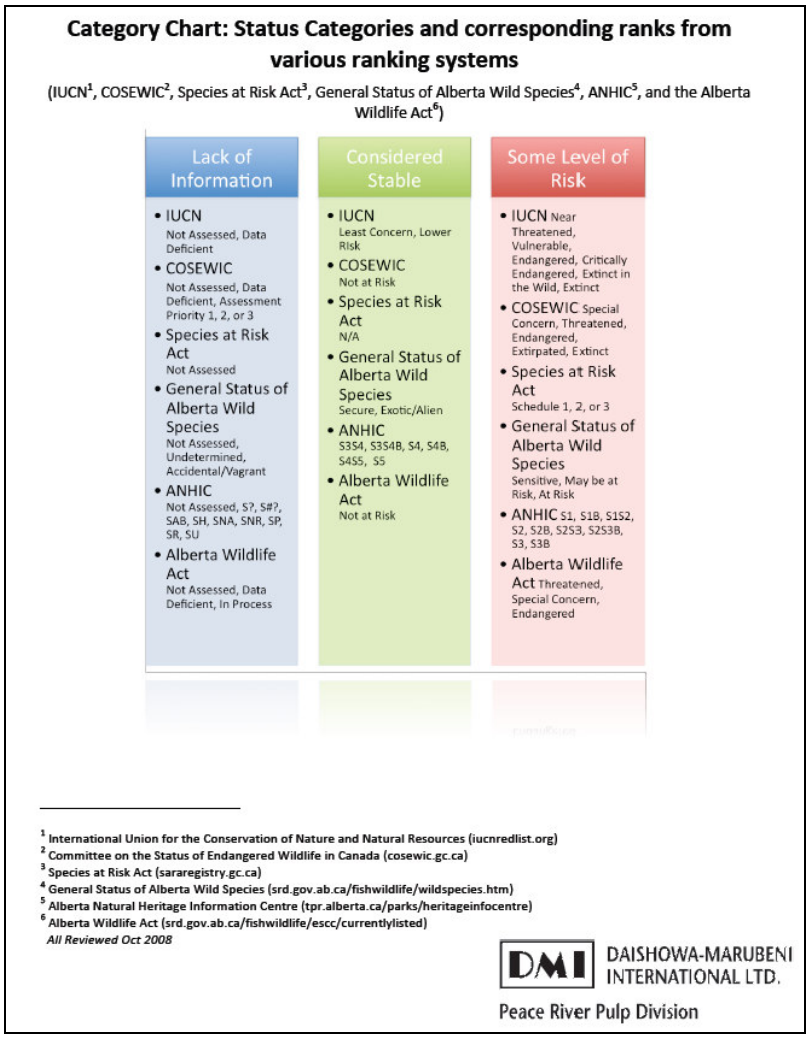


Figure 7.9 : Species Status Categories and Rankings

It is noteworthy that species-status between agencies is not always consistent, as a product of their different scales of assessment (e.g., a species considered stable at a provincial level, may be considered rare at a national scale). These distinct organizations are also each at different stages of working through the various taxa and in many cases notably weak yet in assessing the diverse plant kingdom and invertebrate species as Table 7.6 [40] demonstrates. The six designating agencies do not rank all species or taxa. Species-status lists (international, Canada, provincial) are also fundamentally dynamic in nature because of ongoing advancements in knowledge and changing species-fitness identified through each agency's scientific status-assessment processes for at-risk designation or rarity. Consequently, it is necessary to continually monitor pertinent websites to up-date one's awareness of current high-risk species. Table 7.7 provides a point-in-time indication of the number of regional species

[40] 2010., -Species status 2010 up-dates in northwestern Alberta for the DMI FMA., Fiera Biological Consulting (report prepared for DMI, August 12, 2010)

considered to be of distinct sensitivity (some level of risk) among each of the rating-agencies.

Table 7.6 : Taxonomic Groups Assessed by Designation Agency

IUCN[1]	COSEWIC/SARA	Alberta Wildlife Act[2]	ACIMS	ALberta General Status of Wildlife
Aves	Aves	Aves	Aves[2]	Aves
Mammalia	Mammalia	Mammalia	Mammalia[2]	Mammalia
Reptilia	Reptilia	Reptilia	Reptilia[2]	Reptilia
Amphibia	Amphibia	Amphibia	Amphibia[2]	Amphibia
Fish	Fish	Fish	Fish[2]	Fish
Insecta: Odonata and Hymenoptera	Insect: Lepidoptera (33 spp assessed to date)		Insecta: Odonata, Lepidoptera (butterflies only)	Insecta: Odonata, Lepidoptera (butterflies only), and Tiger Beetles
Molluscs (8 AB spp only)	Molluscs (only 34 spp assessed to date)		Molluscs	Molluscs
Plants (trees only)	Vascular Plants (only 204 spp assessed to date)		Gastropods	Gastropods
	Mosses (only 18 spp assessed to date)		Vascular Plant	Vascular Plant
			Non-Vascular Plants	
			Lichen	

[1]Assessment status as of June 2010
[2]Updated May 2010

Table 7.7 : NW Alberta Species with Some Level of Risk -2010 (count by agency)

Included species: endangered or threatened (at-risk), may-be-at-risk, sensitive, vulnerable, special concern, rare (S1/S2), in-process, or of high assessment-priority

Biotic Group	2010 Species Diversity	IUCN	COSEWIC	SARA	Alberta Status of Wild Sp	ACIMS	Alberta Wildlife Act
Plants-Lichen-Fungi	890	0	1	1	49	217	0
Birds	247	4	13	8	52	28	9
Mammals	47	2	4	4	9	7	3
Fish	35	3	1	0	8	9	2
Herptiles	10	0	2	2	7	4	2
Arthropods (insects)	1271	0	1	1	5	13	0
Gastropods +similar	16	0	0	0	3	2	0
Total	**2516**	**9**	**22**	**16**	**133**	**280**	**16**

As an example of the dynamic nature of species-status lists, a 2007 DMI review of status sources identified 148 species as high-risk (up to and including only S2 ratings), because they were either formally 'at-risk' or otherwise described to exhibit notable sensitivity by one or more agencies. That list included 69 vertebrate and invertebrate species, and 79 species of the plant kingdom (0 fungi, 41 plants vascular, 26 moss & liverworts, 12 lichen, 8 mammals, 6 herptiles, 7 fish, 38 bird, 0 gastropods, and 10

arthropods). The 2010 review tabulated a total species showing some level of risk at 200 species. This notably reflects a net growth of some 52 species receiving sensitive status ratings today. To some degree, this is a factor of improved effort among species designation organizations to assess lower order taxa, but also reflects some actual changes in status for various species. (e.g. Fiera, 2010 noted that bird species have seen an increase in the proportion assessed at some level of increased sensitivity due to habitat loss in the wintering grounds of neotropical migrants.) Figure 7.10 provides a roll-up of the distribution of these species among various taxa (Fiera, 2010).

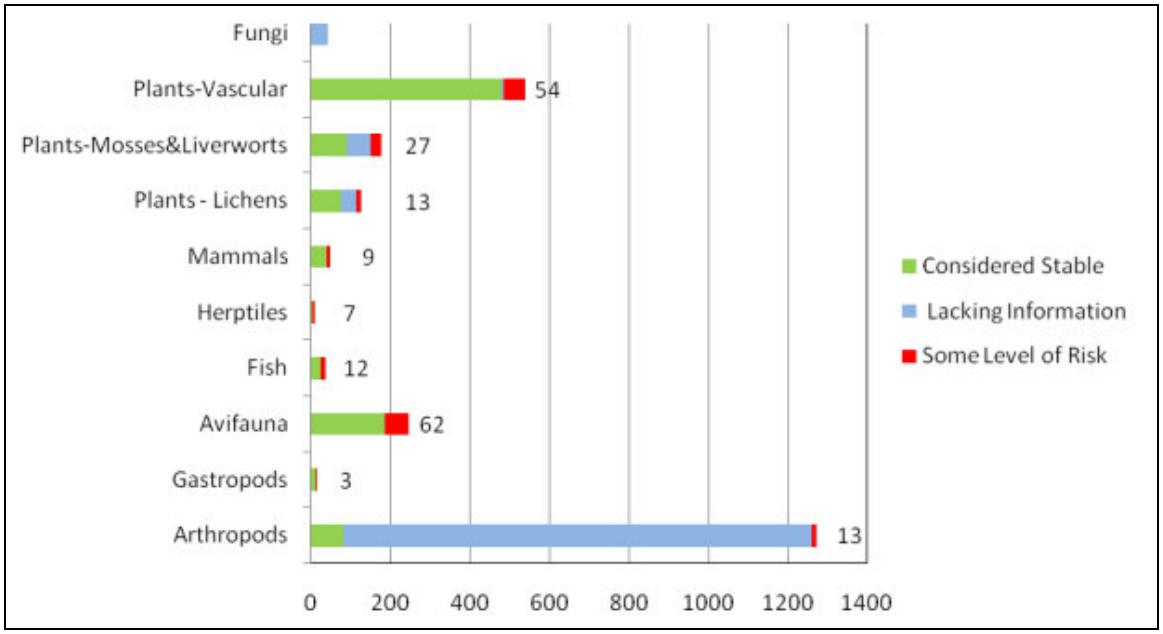


Figure 7.10 : Northwest Alberta High-risk Species Count by Taxa

Among these northern Alberta high-risk species a number are formally protected by federal and/or provincial legislation. Fiera (2010) noted that under federal (SARA) and provincial legislation (Alberta Wildlife Act), 11 and 8 species respectively receive protection. These only include species listed as threatened or endangered status. An additional 7 and 12 species are listed as Special Concern or In-Process under federal and provincial ranking respectively.

Beyond those species categorized as high-risk species, a small group of other species of interest are also commonly identified through a variety of local sources including public advisory groups as well as consultations with various stakeholders (i.e. trappers, openhouse events, GDP presentations) and Aboriginal communities. They represent regional values as game species, fur-bearers or animals associated with fur-species:

American Marten	Beaver	Coyote
Fisher	Lynx	Moose
Red Squirrel	Snowshoe Hare	Wolf

While there are probably other terrestrial or aquatic species of interest to local residents, they were not specifically mentioned during the previous 4-year period of DMI outreach, presumably because residents may have a comfort level that Alberta is actively managing for them.

7.10.3 Mammals

Among vertebrates, mammals are second only to birds in species richness and number of families represented in northwest Alberta. 47 species are found in this region of the boreal forest, the majority of which are smaller mammals such as weasels, mice, voles, bats, shrews, and squirrels. Figure 7.11 illustrates proportional diversity among mammals. As with birds, mammal species richness is related to the diversity of habitat types in the mixedwood and coniferous forests of northwest Alberta, which is, in turn, related to the juxtaposition of several natural subregions of the Boreal Forest.

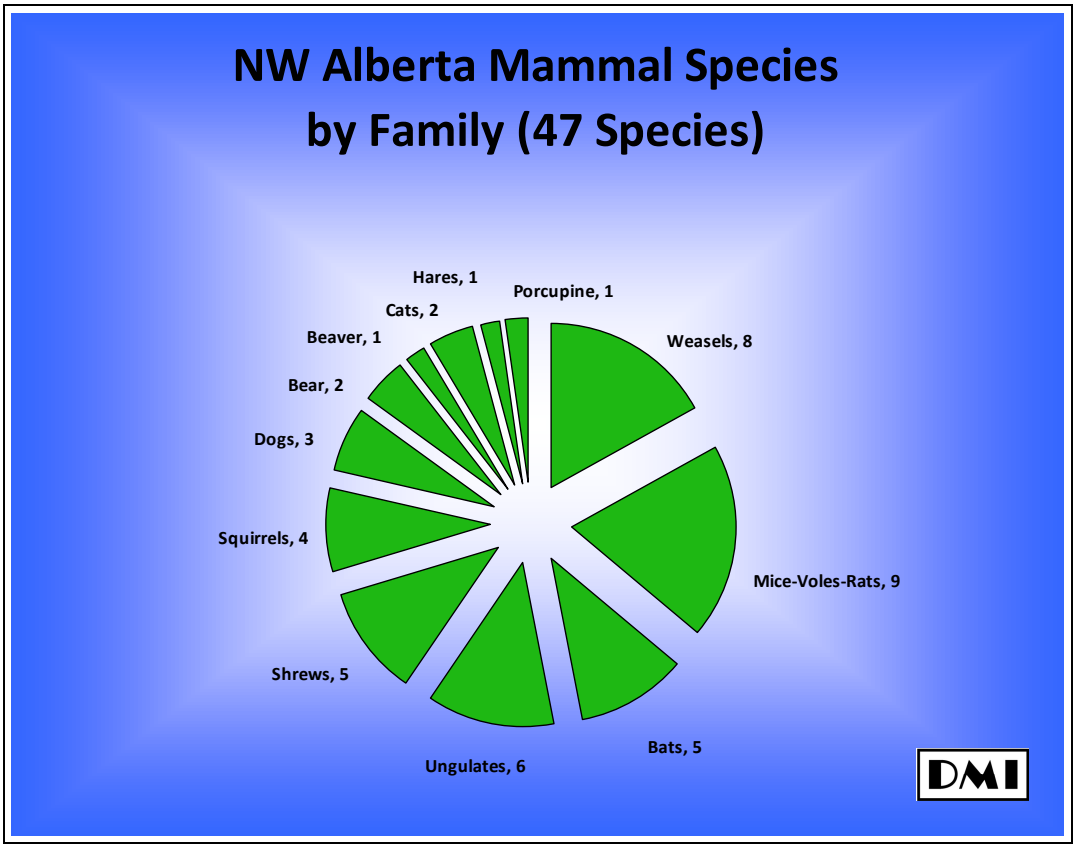


Figure 7.11 : Mammalian Diversity in Northwest Alberta –Proportional Richness

The diversity of habitat is often related to major geomorphic features, such as the Peace River valley and the Caribou Mountains. The natural zonation of the Peace River valley and its tributaries, for example, creates unique habitats through environmental gradients (in hydroperiod, microclimate, and elevation) and bottomland riparian forests (Johnston *et al.* 1996). Those bottomland forests are particularly important as winter range for moose and, in turn, for wolves. The north-facing banks of the rivers provide good denning habitat for black bears because they have stable, snow-covered slopes that are sheltered from the predominant northwest winds, and the south-facing slopes and uplands have abundant forage in berries patches. Similarly, the Caribou Mountains provide habitat for caribou in the black spruce bogs and pine ridges that predominate the Boreal Sub-Arctic Natural Subregion. During the winter, the abundant terrestrial lichens provide good forage habitat, and in the summer the open habitats wind may help provide protection to the caribou from flies.

Much of the region provides good habitat for moose, an important ungulate species value in northwest Alberta. Severe winters and deep snow can limit the habitat suitability for deer: it is secondary for mule deer, except prime along river valleys, and is secondary to poor for white-tailed deer, except around Peace River agricultural regions (Nietfeld *et al*. 1985). Habitat quality for elk is secondary, being prime in select locations. Similarly, the highest densities of marten tend to occur in areas of mature conifer forest, and therefore tend to be dynamic on the landscape over time in response to forest fires and forest succession. Northwest Alberta provides excellent habitat for aquatic mammals such as river otter and beaver (Nietfeld *et al*. 1985). The abundant small lakes and ponds offer abundant habitat for muskrats.

The Alberta government has identified specific wildlife and wildlife zones (Land Management Referral Map) that require special consideration when completing forest management plans and implementation activities. Four northwest Alberta mammals that require such consideration are the Woodland Caribou, Moose, Wood Bison and Grizzly Bears, although formal strategies for regional grizzly populations are yet evolving and uncertain (2010). Northern Long-eared Bats and Wolverines while identified in formal Alberta species status documents as "may-be-at-risk" status, similarly lack formalized polices and strategies to guide forest management consideration. Wood Bison occur north and northeast of the DMI FMA's (Hay-Zama and Wabasca herds) and have otherwise been subject to only very sporadic historical observations within the FMA so will not be addressed in this document. Detailed discussion of this species is however offered in Chapter 3 of the 1999 *Biophysical* document (Stelfox, Schneider)

7.10.3.1 Woodland Caribou

Historically, the woodland caribou occupied all provinces of Canada and extended into the northeastern United States. But since the 1800s, its range has decreased, due to human development, impacts to mature conifer forest habitat, over-hunting, and possibly the role of the white-tailed deer in spreading a parasitic worm in eastern areas. Figure 7.12 illustrates the current distribution of Woodland Caribou in Canada.[41] Within this general distribution a number of localized populations exist, some of which are isolated and do not intermingle with other populations (e.g. some Alberta herds). Environment Canada deemed in a scientific review (2008) that provincially defined boundaries for local populations are jurisdictional in nature and are not in some cases ecologically significant, particularly where animals use landscapes to either side of such boundaries.

[41] Environment Canada. 2008. Scientific Review for the Identification of Critical Habitat for Woodland Caribou (Rangifer tarandus caribou), Boreal Population, in Canada. August 2008. Ottawa: Environment Canada. 72 pp. plus 180 pp Appendices.

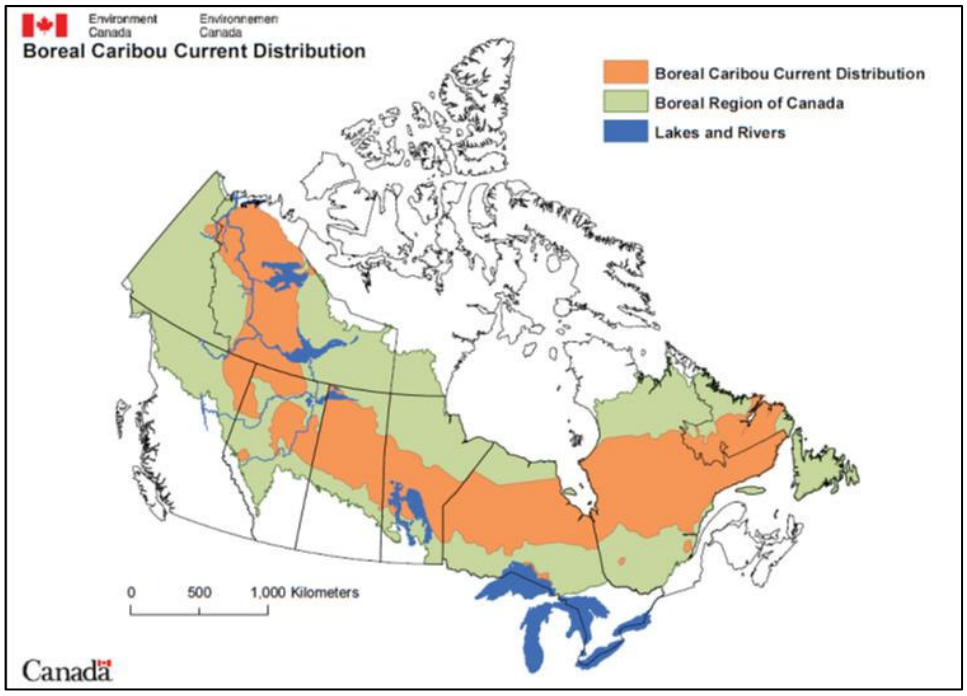


Figure 7.12 : Woodland Caribou Distribution in Canada

The Alberta Wildlife Act lists woodland caribou as a threatened species within the province. An endangered designation was initially established in 1987 and then amended to threatened status in 1997 in response to the general erosion of caribou range throughout North America, to declining numbers at the southern boreal fringe, and to a documented decline of caribou in west-central Alberta (Alberta Woodland Caribou Conservation Strategy 1996). A provincial Status Report was released in 2001 and subsequently up-dated in 2010. Nationally, they are listed as a threatened species under Canada's Species at Risk Act (SARA).

Woodland caribou in Alberta are subdivided into the mountain and boreal eco-types, although both belong to the same subspecies (*Rangifer tarandus caribou*). Boreal caribou in northern Alberta are generally non-migratory, although highly mobile within their ranges in forage pursuits, in reproductive strategies during calving season and in avoidance of predators. Some normal movement across geo-administrative boundaries also occurs on ranges that are shared between the Alberta-British Columbia and Alberta-Northwest Territories borders in northwest Alberta. (e.g., Chinchaga)

Woodland caribou are generally associated with large areas of lower-productivity mature to old conifer forests and forested peatlands. In northwest Alberta, they occupy habitats across a wide variety of natural subregions, with the exception of the relatively small areas of the Peace River Parkland and Peace River Lowlands. Portions of important caribou ranges within proximity to the DMI DFA are illustrated in Figure 7.13. They include the Red Earth herd overlapping a portion of the Eastside FMA, and herds which occupy the Chinchaga range on portions of the Westside FMA (Deadwood-Dixonville and Chinchaga herds). Another historical herd within local landscapes includes the Hotchkiss herd which lies between FMU P19's south and north portions.

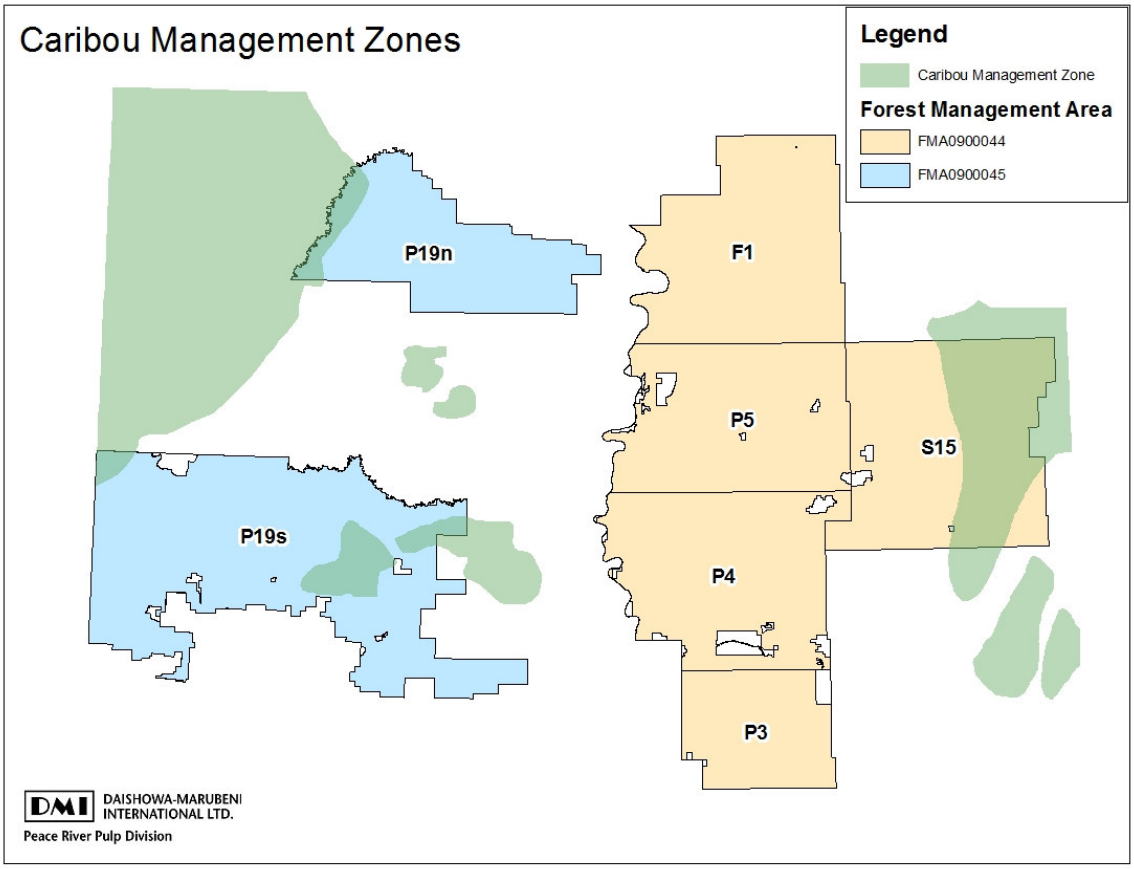


Figure 7.13 : Location of caribou management zones in and near the FMAs.

Among boreal caribou eco-types, their range is primarily associated with open and treed bog and fen complexes dominated by black spruce and larch. Preference for specific plant community types reflects the observation that caribou feed significantly on terrestrial lichens, mainly *Cladina* sp., during the winter. These lichens are abundant in bog and fen habitats, and in upland pine stands. Many of the peatlands are interspersed with upland vegetative types that support other ungulate species (moose, deer) and the predators that depend on those prey species. Alberta research notes that historically the forests used by caribou supported few other ungulates and subsequently few wolves. Their preference to specific habitats permitted them to use spatial separation strategies from other prey species (moose, deer, beaver) thereby reducing their exposure to wolf predation.

Alberta populations are generally quite small in size (n=<500) with many well below 300. Their distinct isolation from other populations and caribou habitat ranges makes them particularly vulnerable relative to other herds in Canada. Accurate population estimates are difficult to obtain because woodland caribou occur at low densities across large ranges, and their cryptic coloration and preference for coniferous habitat makes them difficult to detect during aerial surveys. Population estimates are consequently at best elusive both provincially and federally.

The Alberta Woodland Caribou Conservation Strategy (1996) estimated the provincial population of caribou to be 3,600 to 6,700. The 2010 Status Update report indicated

data to 2005/06 suggested n = 2927-3387 of which 2265-2725 represent boreal population. 2009 Alberta up-dates suggest n = 2608-2849 (boreal pop n = 2074-2315) Table 7.8 illustrates estimated populations and trends for local herds (Environment Canada -2008, and Alberta Status Up-date 2010).[42]

Table 7.8 : DFA Woodland Caribou Population Estimates and Trend (2009)

Geographic Population Unit	**Population Size Estimate** (to 2005/06)	**Population Size Estimate** (2009 Alberta)	**Confidence Limits**	**Population Trend (2008 Env Can)**
Chinchaga – Alberta + BC (incl Hotchkiss + Chin herds)	250-300	250	Professional judgement, best available field data, extrapolations	Rapidly declining, 58% anthropog. disturbance
Deadwood-Dixonville	40		Professional judgement, limited field data	Suspect declining, 63% anthropog. disturbance
Red Earth	250-350	172-206	Professional judgement, best available field data	Rapidly declining, 39% anthropog. disturbance

In general relative to other areas of Canada, some Alberta caribou populations and habitats have seen extensive research and monitoring in the past 2 decades. The resulting scientific literature indicates that caribou declines in Alberta are indirectly related to habitat alteration by cumulative human activities and wildfires, the effects of that on ungulate species populations (deer, moose) consequential to increased early-succession plant communities, and directly related to mortality factors that occur through access (road collisions), increased predation by wolves whose populations respond positively to increased ungulate prey populations, and linear footprints offering increased predation effectiveness to wolves. Table 7.9 illustrates the estimated extent of linear footprint (industrial) and recent history wildfire footprint (perimeter area) within local Alberta caribou ranges.[43]

Table 7.9 : Linear Footprint and Wildfire Disturbance to Caribou Range

Caribou Range	**Range Area (Alberta portion only)**	**Linear Feature Density -km/km2** (pipelines, roads, seismic)	**Percent covered by burns <30 years old** (Alberta portion only)	**Percent covered by burns < 50 years old** (of entire range)
Chinchaga (incl Hotchkiss	17,517km2	3.4	2.6	10.9

[42] Anthropogenic disturbance % (incl 500-meter buffer) drawn from Global Forest Watch Canada

[43] Alberta Government Status report (2010 Up-date). Burns data cited to Boutin and Arienti (2008) and Environment Canada (2008). Linear disturbance data cited to Boutin and Arienti (2008)

+ Deadwood)				
Red Earth	19,977km2	2.1	25.5	28.8

The 2010 Alberta Status update report notes that provincially more populations are now experiencing sustained decline than was the circumstance in the 2001 document. Environment Canada national assessments note that Alberta herds are dominantly in a category for low probability of "self sustaining" population-status as a consequence of small population sizes, herd population decline rates and combined disturbance on their isolated ranges (wildfires, human-activity -industrial, agriculture, roads, etc). Projections for Alberta forecast increasing growth in future industrial activity, continued influence of wildfire on caribou habitat and climate envelope influences (habitat state, forage and geographic position). Provincial land-use guidelines for industrial activity to-date have not succeeded in altering long-term population trends, in isolation of other simultaneous intervention strategies (Alberta status report, 2010). A number of collaborative initiatives have been formed over the years in an attempt to find solutions between government, industry, academia, Aboriginal peoples and non-government organizations.

Detailed research on caribou population and habitat use focused on the eastern slopes region in west central Alberta from the late 1970s to the 1990s. Research in northwest Alberta in the 1990s was coordinated by the research subcommittee of the North West Region Standing Committee for Caribou (NWRSCC), which is a co-operative between the forest industry, energy sector, provincial government, and First Nations. The two northern Alberta regional committees (NWRSCC and the North East Region Standing Committee for Caribou -NERSCC) eventually amalgamated to form the Boreal Caribou Committee, which coordinated further research and the development of interim industrial guidelines and best management practices (BMP's)[44] across northern Alberta until 2005.

Northwest Alberta research has been extensive and in-particular provided valuable understanding of calving dates, fidelity to calving sites, feeding sites, bedding sites, and daily rates of movement. An extensive winter tracking effort was undertaken in the Red Earth and Caribou Mountains ranges (1995 to 1997). This provided insight into specific activities in selected habitats and has provided the opportunity for collection of fecal pellets to study food habitats. Recent caribou research in northwest Alberta has been focused primarily on improving caribou population information for low-data herds, understanding herd movements (habitat use, seasonality), monitoring calf recruitment and adult mortality factors, and clarifying predator occupancy densities which in some cases (circa 2009 Chinchaga, Hotchkiss, Deadwood) are proving relatively high. Information about calf production and calf survival is obtained through aerial surveys twice per year. In the first survey, conducted in conjunction with the radio telemetry flights from April to June, the ratio of calves to collared cows is recorded. Aerial surveys conducted the following March are based on a substantially larger sample of the population, using the collared animals to locate groups of caribou.

Classification of the peatland component of the landscape was incorporated into the new Alberta Vegetation Inventory (AVI) collected by DMI in the High Level area when the company held northern tenures. When matched to caribou telemetry observations, this inventory provided an important opportunity to evaluate caribou habitat selection.

[44] 2001. Boreal Caribou Committee. Strategic Plan and Industrial Guidelines for Boreal Caribou Ranges in Northern Alberta

Pre-1994 Harvest Planning and Operating Ground rules in Alberta had been developed primarily considering moose habitat as a priority species (e.g., small cutblock, limited line of sight). Science has revealed that such harvesting regimes result in fragmentation of important caribou habitat. Increased early succession vegetation in upland habitat also encourages ungulate (moose, deer) population growth, and likely leads to increased wolf numbers peripheral to caribou habitat, thereby increasing the potential for caribou predation. Current landscape management strategies consider alternatives to manage forest state in caribou range that might emulate more natural wildfire-driven forest patterns (patch size, shape, stand age distribution and stand composition) in which caribou evolved. Broader industrial development in caribou range however can significantly increase density of linear disturbances (roads, seismic, pipelines) that lead to increased human access (vehicle collision risks), ungulate travel into caribou range, and more efficient predation. Alberta's landscapes need additional integrated strategies for industrial development that strive to manage and restore linear footprint, along with Alberta management of predator and other ungulate populations.

In 2005, all collaborative caribou organizations in Alberta were consolidated by the Minister into one Alberta Caribou Committee (ACC). In 2005 a Recovery Plan was completed for the Minister. Specific portions were endorsed for initiating sequential development and recommendation of regional strategies through multi-disciplinary Landscape Planning Teams under ACC instruction. In 2006, a synthesis of research gaps and state-of-science (biology, impact pathways) was completed for the ACC (Golder Associates) toward guiding further science and recovery strategy development. In 2007 a national synthesis of knowledge regarding Canadian Woodland Caribou distribution, habitat and biology was published.[45] At 2010, the Boreal Caribou Committee interim guidelines (2001) remain the source-point for northwest Alberta industry practices. The formalized ACC process for regional planning was merged eventually with the Alberta Land-use Framework before any northwest caribou Landscape Planning Teams were formed by the Province, and to 2010, no such regional planning has been initiated in northwest Alberta.

Alberta is engaged in National Recovery Plan finalization and Environment Canada scientific works attempting to improve clarity of "critical habitat" definitions, range boundaries, disturbance thresholds, best available habitat, best management practices, herd priorities and climate change strategies. Alberta landscapes are becoming increasingly scrutinized and assessed by non-governmental organizations (e.g. Global Forest Watch Canada), Aboriginal communities and the international marketplace all interested in seeking solutions to caribou declines in the Canadian boreal forest. In 2011, the Province is moving to finalize a new action-based caribou policy framework with input from the ACC that will address a comprehensive suite of strategies.

7.10.3.2 Moose

Moose (*Alces alces*) are distributed throughout the forested regions of Alberta and are a common ungulate of northwestern Alberta. Among ungulate species, moose receive tremendous consideration by natural resource managers due to the species' socio-economic value to the general public and its cultural importance to Aboriginal peoples.

[45] 2007. National Council for Air and Stream Improvement (NCASI)., State of Knowledge and Analysis of Current Research on Woodland Caribou in Canada., Technical Bulletin 939

Moose are wide-ranging, considered secure status in Alberta[46] and are generally seeing no communicated concerns from wildlife managers regarding population fitness within the region.

Historically, due to the social and economic importance of moose, habitat management favouring this species had been a dominant biodiversity consideration in the development of timber harvest planning and operating ground rules in northern Alberta prior to 1999. While it continues to remain important, increased balance in the attention afforded other boreal species with similar or conflicting habitat needs is a current demand that challenges landuse policy-makers, species managers and forest managers alike.

Local distribution and abundance of moose is related to successional stages of vegetation, created by natural disturbances such as wildfires, flooding (beaver activity, seasonal watercourse flooding), as well as from human activities such as forest harvests, agricultural land clearing, access construction and prescribed fires. These successional forces and associated changes in natality and mortality of moose populations account for the dynamic nature of moose populations (Franzmann 1978). Food and localized climate factors (thermal conditions) are perhaps among the most important aspects of habitat for moose. Forage preferences include willow, red-osier dogwood, white birch, aspen, balsam poplar and saskatoon (Allison 1972; Nowlin 1976) which are prevalent in early succession stages of forests as well as in association with the interface between wetlands and upland.

Forest harvesting is generally beneficial to moose foraging requisites because mature forests are converted to early succession stages seeing abundant new forage. However, this relationship is affected by the juxtaposition of habitat types that meet the requirements of moose for both food and cover from predation and hunting. Former forest harvest planning and operating ground rules in Alberta had been significantly influenced by moose habitat considerations (e.g. block size, width, line-of-sight, thermal cover). Former two or three pass harvest systems strived to maintain intermixed cover and relatively small block sizes offering close proximity of forage and treed cover which collectively contributed to increased habitat carrying capacity. Some literature suggested that pre-1990 moose populations in Alberta did not increase dramatically in the vicinity of harvest blocks, but this may have been a function of disturbance (vegetation dynamics) and hunting efficiency (success) resulting from improved access (Brusnyk and Westworth 1988). Collisions with vehicles can also be a significant cause of mortality, particularly with increasing densities of northern Alberta access infrastructure and increased local traffic volumes in winter seasons.

An increasing body of Woodland Caribou research is pointing to the role that increases in browse forage availability (initiated by industrial forest disturbances) contributes to moose/deer population density and the consequential growth of wolf densities in response to moose and deer prey availability. Since predation by wolves is a mortality factor, increased snow density, crusting of snow surface and linear disturbances allow wolves to manoeuvre better, increasing predation advantage on moose. Deep snow periods often result in concentrations of moose, making individuals more accessible to wolves. Black and grizzly bears can also contribute significantly to moose predation, particularly on calves.

[46] Alberta government. 2005., Status of Alberta Wild Species (online web version)

Moose dispersal and survival in winter appears largely regulated by snow conditions. Snow influences the timing, distance and energetics in movements by moose. In particular the energy balance of moose is influenced by metabolic demands of locomotion in the avoidance of predators or sensory disturbance, the pursuit of forage and the drains caused by ticks or other parasites. Low nutritional status, associated with snow conditions, can also increase vulnerability of moose (Peterson and Allen 1974). Limited forage carrying capacity or distance between forage, low thermal cover opportunity and sensory disturbance present additional pathways for decreasing energy reserves particularly in winter. This creates distinct vulnerabilities for pregnant cows as well as cow-calve pairs.

Moose populations and density are assessed by Alberta within designated Moose Management Areas. The DMI DFA occurs largely within two (MMA 7, 8) that are illustrated in Figure 7.14.[47] Mid-1990's data posted on the Alberta government website suggests population densities at 0.34 – 0.93 moose / km2 (MMA 7) and 0.11 – 0.62 moose / km2 (MMA8), among the various individual Wildlife Management Units.

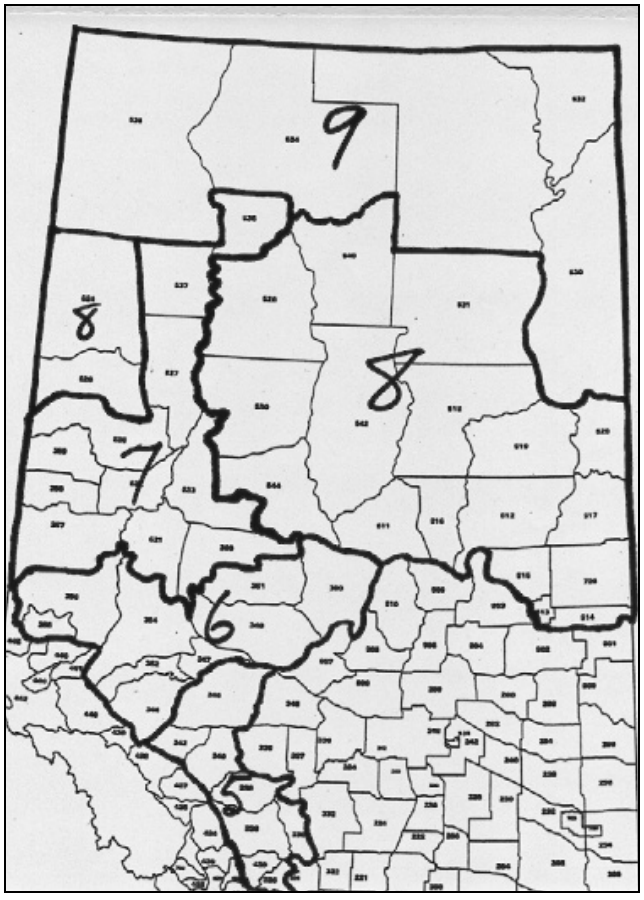


Figure 7.14 : Alberta Moose Population Management Areas

[47] Alberta government website. 2010., www.srd.alberta.ca (Managing Programs / Fish Wildlife Management / Northern Moose Management Program)

Alberta ungulate populations and densities are monitored by a system of rotational Aerial Ungulate Surveys (AUS). In 2007, the Alberta Conservation Association became an active partner in the AUS program, and works collaboratively with Alberta to conduct surveys and to summarize survey data.[48]

Industry activities that consider key species vulnerabilities are focused on two categories of special moose habitat range; riverine winter ungulate zones, upland special access zones. Special operational strategies and restrictions are defined by Alberta for each zone, which in the DMI DFA is illustrated in Figure 7.15.

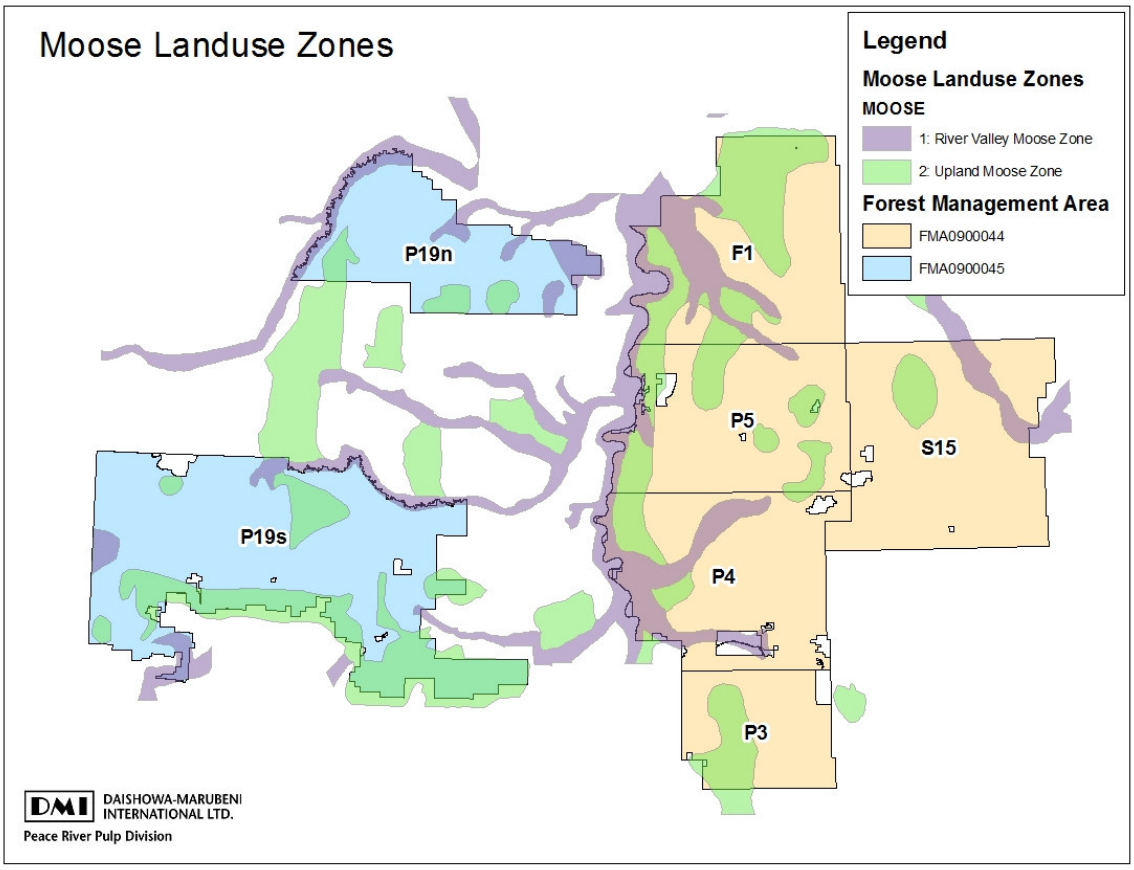


Figure 7.15 : DFA Moose Landuse Zones

7.10.3.3 Grizzly Bear

The Alberta Wildlife Act lists Grizzly Bears (*Ursus arctos*) as a threatened species within the province. Nationally, they are considered a "special concern" species under Canada's Species at Risk Act (SARA). Their distribution extends through the montane,

[48] Alberta Conservation Association website. www.ab-conservation.com (Programs-Wildlife, AUS)

foothills and northwest boreal forest regions as approximated in the shaded area on Figure 7.16.[49]

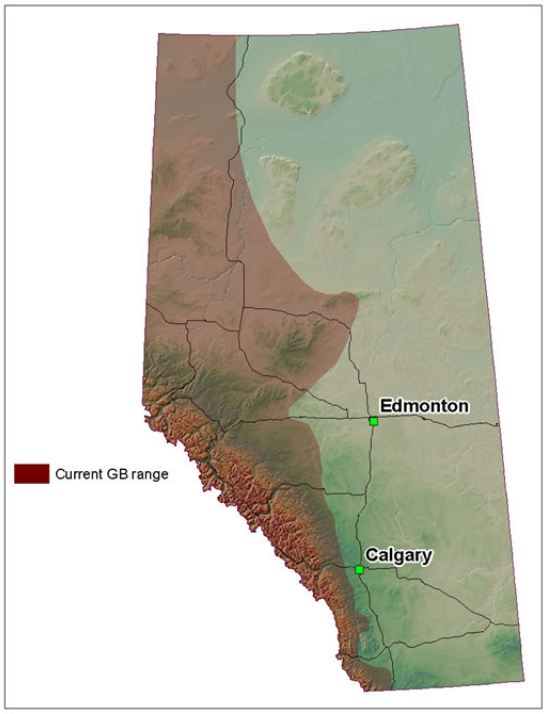


Figure 7.16 : Alberta Grizzly Bear Range

Important habitat in northern Alberta is only coarsely delineated to-date, with no official declaration of priority Grizzly Bear Conservation Areas containing "core habitat" or "secondary habitat"(dispersal zones) in northwest Alberta. At 2010 northern Alberta grizzly populations remain the subject of ongoing provincial research initiatives attempting to better quantify them. These projects are yet clarifying local habitat use, range size and temporal patterns of landscape movement which may be unique relative to foothills or montane grizzly populations. Bears in northwest Alberta may be genetically distinct from grizzly bear population units south of Grande Prairie.[50] Yet, population estimates for northwest Alberta grizzly have proven elusive due to lower densities and forest cover challenges that hamper bear detection and captures. Nonetheless, the 2010 update to the status of grizzly bear in Alberta published an estimate of bear populations across the province using varied calculation methods and best available data as presented in Figure 7.17.[51] Map Figure 7.18 provides some refinement of geographic delineation for grizzly bear habitat use in northwest Alberta which considered a variety of record sources from recent history (grizzly sightings,

[49] Foothills Research Institute., Alberta Grizzly Bear Research Program. Gordon Stenhouse

[50] Personal communications, 2008; Gordon Stenhouse –Foothills Research Institute

[51] 2010., Alberta Government and Alberta Conservation Association., Status of the Grizzly Bear (Ursus arctos) in Alberta: Update 2010., Wildlife Status Report No. 37., 44pp.

mortality reports, professional expertise).[52] Northern Alberta populations have been confirmed by Foothills Research Institute projects to range over significantly large landscapes, including migration between Alberta and northeast BC, and are suspected to be using higher-elevation topography features and dominant riparian corridors to assist that movement.[53]

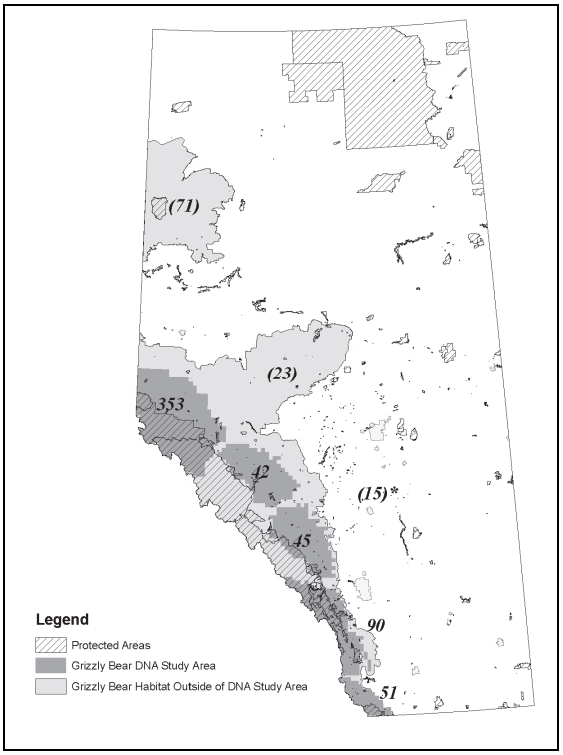


Figure 7.17 : Alberta Grizzly Bear Populations Distribution (estimation)

Bracketed figures represent estimates derived through methods other than DNA-based census

[52] 2010 Alberta government
[53] Personal communications; 2006 to 2010 Gordon Stenhouse, Grizzly Bear Research Program Manager, Foothills Research Institute

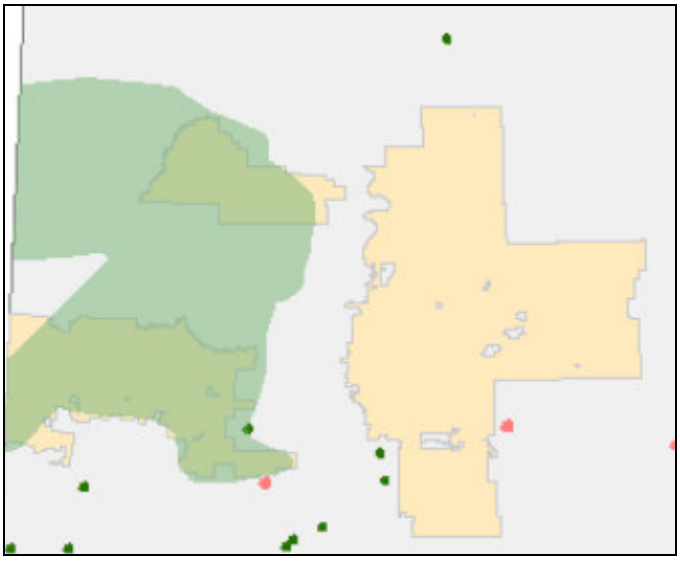


Figure 7.18 : Northwest Alberta Grizzly Bear Zone

As the above figures illustrate, it is likely that grizzly bear range in northwest Alberta is currently smaller than original delineation suggested before recent research. This may be a product to some degree of habitat transformation through agricultural development. The 2010 status report assumes a population of 71 bears north of the Peace River, the average of the discounted estimate from the 2002 status report and the estimate by Stenhouse et al in 2005, though the estimate is of unknown precision or reliability.

Grizzlies are habitat generalists, preferring forest edges during foraging season, but otherwise demonstrating high flexibility in the types of resources used depending on the ecosystem, season and level of human disturbance.[54] They are highly mobile in their trophic pursuits, utilizing a large variety of vegetative, vertebrate and invertebrate sources as they become available through the course of the non-frozen season.

The study of this species in Alberta has revealed bear sensitivities and key management issues that are varied in both the source and the benefit or risk to bears. Winter den disturbance (interruption) and sensory disturbance during spring den emergence period for females with cubs of the year presents direct risks. Altered habitat has an attractant effect through increased forest openings, forest edge and new forage source availability from forest harvesting (forest density associations, early seral class understory plant assemblages). This presents both benefits (bear forage) and risks (bear exposure to human presence). Ungulate occupancy and population response to early seral class understory plant forage attractants through altered habitat also presents the positive benefit of prey food sources for bears. Reforestation practices as well as natural post-harvest succession, present potential changes to understory plant assemblages (forage biomass volume, variety and quality) along with increased ungulate (prey) opportunity.

Mortality risk from human-bear encounters (collisions, poaching, recreational self-defence encounters) increases through various access-related issues. Line-of-sight in newly created bear foraging areas (harvest blocks) may be both problematic in exposing bears and beneficial in the prevention of accidental encounters with humans using the

[54] Personal communications, 2006; Scott Nielsen, University of Alberta, FRI –Grizzly bear Resource Selection Function (RSF) model specialist

landscape for various purposes. New-access locations relative to vulnerable bear habitat (temporal occupancy of early seral class sites), core bear habitat and movement corridors (secondary habitat) present an increased risk of encounters. Open-access density (all linear disturbance classes) is suggested to be correlated with bear mortality statistics and risk due to a combination of additional early-seral forage attractants, increased human use (public, industrial), and consequential increased human:bear encounters. Solutions seem to lie in a combination of access management (restoration, closures, policy), strategies to maintain landscape connectivity among areas of low mortality risk from human encounters, as well as awareness of species sensitivities (industry workforce, public, agriculture sector).

In 2005 a draft Recovery Plan was developed and then finalized in 2008 for the Minister following an independent peer review and a moratorium on hunting the species in 2006. Specific portions of that plan were endorsed for implementing recovery actions that included official declaration of priority Grizzly Bear Conservation Areas for landscapes south of Grande Prairie, an Alberta BearSmart education program, grazing lease management strategies, problem bear management strategies and integration of GIS-based tools and new industry practices into planning (landuse, access, forestry) where adequate datasets exist. Active grizzly research in northern Alberta is attempting to further address data-deficiencies in current understanding of population size, health and reproductive connections to environmental stressors, northern boreal movement patterns, habitat use and current range definition for northwest Alberta populations. At 2010, this research was primarily being driven by the Foothills Research Institute in collaboration with various industry, academic, national and provincial government partners who participate in both or one of two research activity teams.

7.10.3.4 Northern Long-eared Bat

Northwest Alberta forests provide habitat for 5 species of bats. One species, Northern Long-eared Bat (Myotis septentrionalis) is considered to be of “may-be-at-risk” status in the province (2005), yet understanding of their density, distribution and key habitat features is rather poor, particularly in northwest Alberta.[55] The status designation in this case is based on relative rarity of the species and its reliance on mature forest habitats, yet recent Alberta work in the boreal is creating some debate about its relative abundance in northern Alberta and whether distribution is widespread or potentially patchy in some Alberta areas.[56] Genetic confirmation of species captured during inventory work, selection of capture methodologies and location of sampling all present confounding challenges in assessing this species from other bat species. At the same time, climate change and fungal infections (White Nose Syndrome) appear to be additional factors of uncertain influence on their persistence.

Alberta knowledge of distribution, distinctions between summer/winter habitat requirements, overwintering mechanisms, reproductive nature, dispersal movements between seasons, and population trends for all provincial bat species is extremely limited.[57] Estimation of Northern Long-eared Bat population size is hampered by difficult detection of forest-dwelling bats in general (Alberta 2009). Consequently after

[55] 2006, Personal Communications; Robert M.R. Barclay, University of Calgary (January 2006)
[56] 2009, Status of the Northern Myotis (Myotis septentrionalis) in Alberta: Update 2009. Alberta government and Alberta Conservation Association. Wildlife Status Report No. 3., 34pp.
[57] 2001, “Survey of the Bats of Central and Northwestern Alberta”, Alberta Species at Risk Report No. 4

20 or more years of sampling, Alberta has no baseline for understanding bat population trends. Northwest Alberta inventory to 2001 included only 89 captures, 29 of which were this species. Despite the presumed susceptibility of hibernating bats to disturbance (mortality risks), knowledge on recurrent locations of northern boreal forest hibernacula for over-wintering bat species also appears to be extremely limited. Equally weak is the knowledge of migratory information for the two species of migratory bats in the province. The distribution of the Northern Long-eared Bat is illustrated in Figure 7.19.

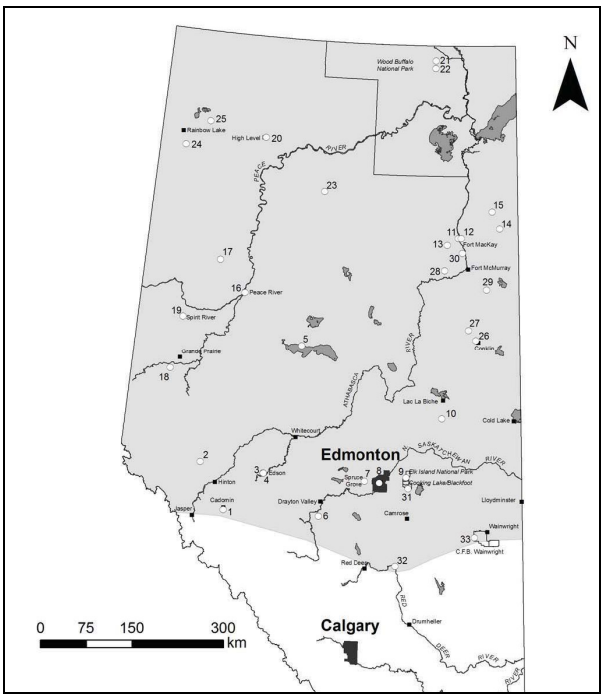


Figure 7.19 : Northern Long-eared Bat Distribution in Alberta

Bats have been documented to exhibit fidelity to foraging grounds, of which forested ecosystems provide significant habitat structure and food sources. Riparian areas also appear to be documented important foraging areas, probably due to extensive insect populations near them. Research documents the general importance of bat roosting sites as one habitat requisite, particularly the conservation of trees with characteristics meeting this need. Detection of active sites remains problematic for forest management applications since bat coloration, size, nocturnal tendency and use of such forest structure is highly cryptic. Generally, older trees were thought to be preferred for roosting sites due directly to decay influence on this vertical structure as well as the tendency particularly among females to roost in cracks, hollows or under the bark. Studies from other areas of Northern Long-eared Bat distribution may contradict this in noting the species can be a generalist in using a variety of tree heights and diameters in a range of stand ages (Alberta 2009). This may point to species adaptability or local variations in ecology and behaviour.

In Alberta mixedwood forests, bats appear to prefer old deciduous trees (aspen) for roosting, but have also been observed at high activity within conifer forests. Some limited understanding specific to northern boreal landscape context has been gained

through local bat research projects[58] associated with the EMEND research forest (Ecosystem-based Management Emulating Natural Disturbance). These studies document the mosaic of open, thinned and intact patches of forest (different tree densities) that are likely to satisfy the behavioural and commuting requirements of a variety of bat species as well as abundance of their prey (insects). A mixture of vertical structure and various stand-closure densities appears to be necessary to meet specific requisites that vary between bat species. Until summer and winter habitat requisites are better understood for the Northern Long-eared Bat, some uncertainty remains regarding the influence of current landuse activities on long-term population viability (Alberta 2009). While this species is afforded no legal protection as an endangered species its hibernacula is protected from disturbance between September 1 and April 30 (Alberta Wildlife Act). The issue in applying this appears to remain in the difficulty detecting such sites.

7.10.3.5 Wolverine

The Wolverine (*Gulo gulo*) is considered to be of "may-be-at-risk" status in the province (2005). Nationally they are considered a "Schedule 3 special concern" species. Consultation with Alberta expertise[59] indicates much existing wolverine data originates from research limited to the province's foothills ecosystems, the NWT and B.C., noting also that boreal forest population habitat requisites may be distinct. Alberta knowledge of northern boreal wolverine population density, distribution, summer/winter habitat requirements, reproductive nature, key habitat components and spatial behaviour in patterns of landscape-use is largely yet forming. West-central Alberta studies of the species provide only preliminary insight on their occurrence and ecology specific to that area of Alberta, with knowledge on northern boreal populations remaining less explored yet suggested as one priority area for wolverine research needs.[60] Population estimates are elusive (speculative 2003 at n=<1000 breeding), and general trends tend to be based on range, distribution and relative temporal availability revealed in trapping harvest records.[61] Figure 7.20 illustrates wolverine distribution in Canada.[62]

[58] 2003, Patriquin KJ and Barclay RMR; "Foraging by bats in cleared, thinned and unharvested boreal forest", + 2002, Hogberg LK, Patriquin, Barclay; "Use by bats of patches of residual trees in logged areas of the boreal forest"

[59] 2006, Personal Communications; Jason Fisher & Steve Bradbury, Alberta Research Council

[60] 2009, Fisher JT, Bradbury SM, Fisher AC, Nolan L.. –"Wolverines on the Edge of Alberta's Rockies" (research from Alberta Wolverine Experimental Monitoring Project and Willmore Wilderness Wolverine Project), Alberta Research Council

[61] 2003, Alberta Species at Risk fact sheet; Alberta's Wolverine

[62] 2009, Canadian Geographic

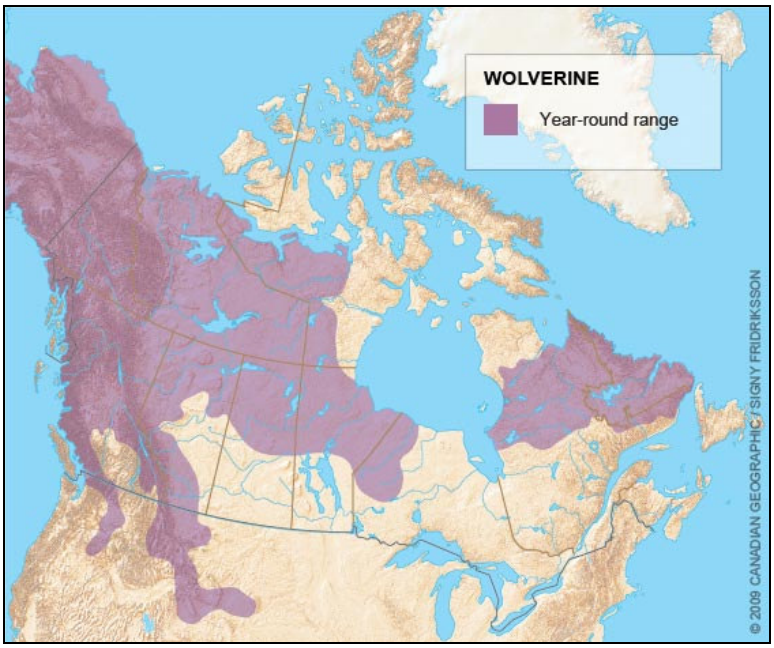


Figure 7.20 : Wolverine Range –North America and Alberta

Fisher et al (2009) noted that wolverines are habitat generalists, so habitat selection varies across their diverse geographic range. Two habitats appear significant in importance; natural open areas (including open muskeg), and dense older-forest structure (particularly conifer). Fisher et al suggest that wolverine survival is influenced more by food availability though than by forest communities and vegetation, as their predatory diet is very diverse. Historical evidence has suggested strong avoidance of anthropogenic open-areas including harvest blocks and linear features, as a probable risk avoidance behaviour strategy of the species. While numerous studies have pointed to negative correlation between road-density or human-disturbed areas and wolverine occurrence, one long-term monitoring program in the northern boreal region has recently noted that wolverines may exhibit adaptive tolerance to some levels of activity, and in the study area were evidencing capacity to re-occupy areas of territory after industrial activities decrease.[63]

Habitat-use (foraging and caches) is believed to occur in similar scale-size to that of other large carnivores (large landscape-scale home ranges).[64] Large home-range requirements, low densities, and low recruitment make wolverines sensitive to overexploitation (Fisher et al 2009). An examination of several wolverine studies noted that the combined influence of trapping and road mortality had accounted for 46% of known-cause wolverine mortalities.[65] Seasonal sensitivities exist during the mating season (May to August), and the birthing season (February to March), since like other

[63] 2006, Ernst Environmental Services & Pioneer Natural Resources Canada Inc. - "Year eight: Working towards an understanding of cumulative effects", (Chinchaga NW Alberta, NE BC)

[64] 1997. Petersen S., Status of the Wolverine (Gulo gulo) in Alberta, Alberta Wildlife Status Report No. 2., 17pp.

[65] 2004, Krebs J, Lofroth E, Copeland J, Banci V, Cooley D, Golden H, Magoun A, Mulders R, Shults B., -Synthesis of survival rates and causes of mortality in North American wolverines. Journal of Wildlife Management 68(3): 493-502

large carnivores, reproductive potential is low. Rearing is supported by den-locations of snow-structure or windthrown trees, with evidence of some fidelity in consecutive years to the same area for future denning sites. Fisher et al suggest that habitat connectivity is important to maintain populations of such low-density species, and habitat type is expected to influence availability of den sites. The last decade is seeing some growth in understanding of northern boreal wolverine habitat features, particularly cache site characteristics and travel routes.[66]

While timber harvesting, oil and gas activity, human settlement and a wolverine fur harvest all occur in Alberta's forests, quantified understanding of wolverine response to forest harvesting and other anthropogenic disturbance in Alberta has not been examined.[67] Fisher et al (2009) indicate that studies to-date have not revealed whether natural wildfire and anthropogenic harvest blocks differ in wolverine habitat quality. With regard to den sites, while science notes evidence of some fidelity in consecutive years to the same area for future denning, it is not known whether Alberta FWMIS data contains many documented locations within the northwest region nor whether science has clarified dimensional aspects of effective buffering for sensory disturbance.

7.10.4 Birds

Forty-three different bird families are represented in northwest Alberta and are comprised of 247 different bird species. Those families containing the most bird species in northwest Alberta, i.e., Warblers, Ducks/Geese, Sandpipers and Gulls/Terns are comprised of species that breed in North America but winter in more equatorial latitudes. The region also hosts approximately 24 species of raptors, 12 of which are considered sensitive by various agencies. Clearly, the boreal forest is a major contributor to bird communities found elsewhere in North, Central and South America. In fact the mixedwood region in particular sees a significant influx of highly diverse migratory bird species along with non-migratory resident species during the active nesting season. During a decade of investigation (1995 to 2004) western Canadian research has revealed the incredible value of aspen-dominated forest regions in sustaining diversity among bird species (Sustainable Forest Management Network, Environment Canada). Figure 7.21 illustrates proportional diversity among northern Alberta birds.

[66] 2004, Wright J. and Ernst J., -1. Effects of mid-winter snow depth on stand selection by wolverines, Gulo Gulo luscus, in the boreal forest. {118 (1): 56-60} and 2. Wolverine, Gulo gulo luscus, resting sites and caching behaviour in the boreal forest. {118(1): 61-64}, Canadian Field Naturalist

[67] 2005, Fisher JT and Wilkinson L., -The response of mammals to forest fire and timber harvest in the North American boreal forest., Mammal Review 35 (1): 51-81

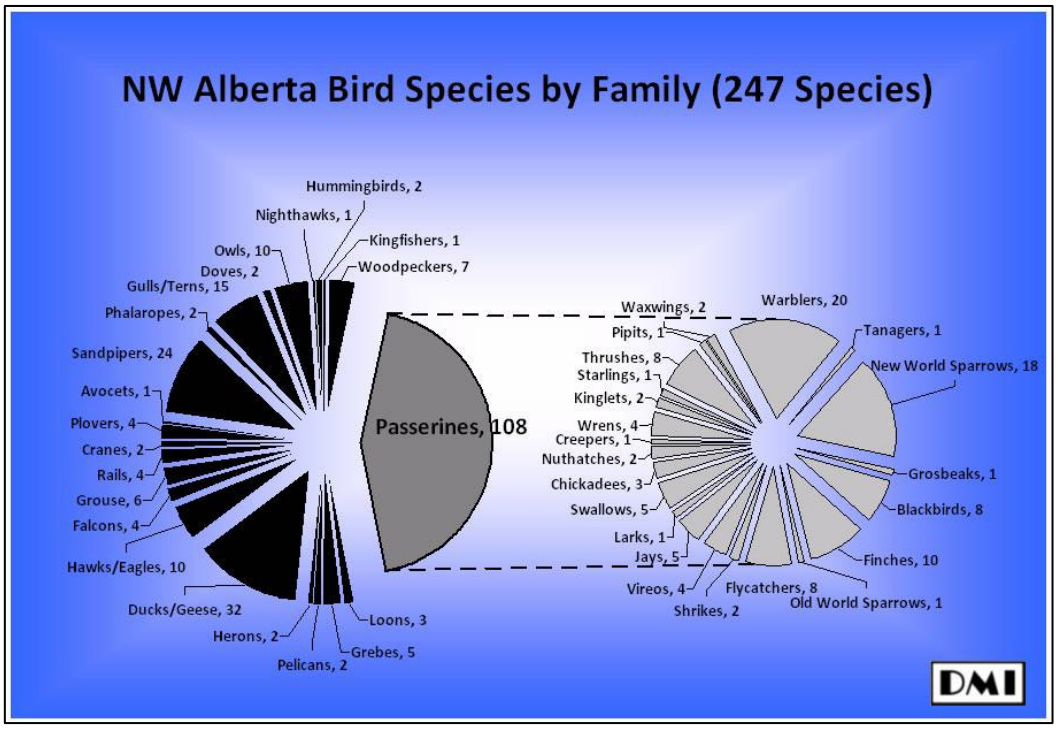


Figure 7.21 : Northwest Alberta Bird Diversity

The intercontinental scale at which birds function presents complex challenges in assessing and monitoring populations. Unravelling population trends and changes in abundance of the migratory species will of course be confounded by human landuse practices, hunting management and habitat quality in Canada and elsewhere. Nonetheless Environment Canada, a collection of non-governmental stewardship organizations, provincial governments and North American conventions have been collaborating extensively to develop improved capacity to monitor, evaluate and report on those dynamics. (e.g., Bird Studies Canada, Boreal Avian Modelling Project, Boreal Songbird Initiative, Canadian Migration Monitoring Network, eBird Canada, Ducks Unlimited, Lesser Slave Lake Bird Observatory, North American Bird Monitoring Projects Database). Environment Canada (Canadian Wildlife Service) manages a dedicated website reporting on Status of Birds in Canada, and is developing some 25 eco-regional Bird Conservation Plans to guide strategic conservation efforts across the 12 Bird Conservation Regions in Canada (Figure 7.22). These plans will eventually provide an improved framework for provincial government and industry collaboration in habitat and population management. The DMI DFA is covered by the Boreal Taiga Plans region (Bird Conservation Region 6).

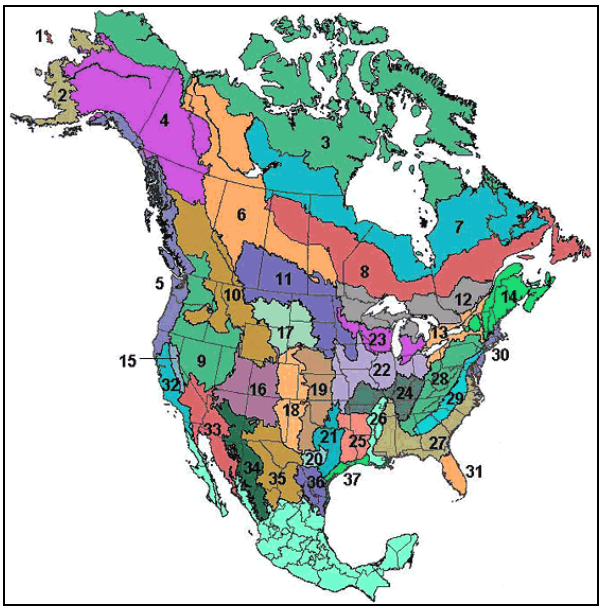


Figure 7.22 : North American Bird Conservation Regions

A fundamental precept in integrating bird conservation with forest management is some understanding of the habitat and nesting preferences of regional bird species. Stelfox summarized earlier state of knowledge in the 1999 *Biophysical* document. Since that time, avian science from a collection of sources in the western boreal has greatly built upon that in further describing the profile of habitat use by bird species in the region. The footnotes reference only some of them.[68] The general habitat preferences of bird species in northwest Alberta are presented in Figure 7.23. It is noteworthy that a number of these species depend directly on forest stands (deciduous, mixedwood, conifer), while others depend on grassland, open habitats or their interface areas (agricultural area fringes), and others focus on wetlands. Many depend on combinations of these, exhibiting more generalist behaviour. Those highlighted in green represent the proportion of species that generally depend on forests or forest interface area for at least part of their life cycle, in particular those forests that might dominantly be the focus of DMI DFA activities.

[68] Sources: Fisher, C., Acorn, J. 1998. Birds of Alberta, Field Guide. Lone Pine Publishing. Edmonton, Alberta,Canada. + Semenchuk, G. P., editor. 1993. The Atlas of Breeding Birds of Alberta. Federation of Alberta Naturalists. Edmonton, Alberta, Canada + Daishowa-Marubeni International Ltd., Fish and Wildlife Services. 1993. Habitat Requirements of 177 Forest Dwelling Wildlife Species on the DMI FMA. Daishowa-Marubeni International Ltd. Peace River, Alberta, Canada + Jul Wojnowski - Lesser Slave Lake Bird Observatory, Lesser Slave Lake Provincial Park, Slave Lake, Alberta + Glen Semenchuk - Federation of Alberta Naturalists, Edmonton, Alberta

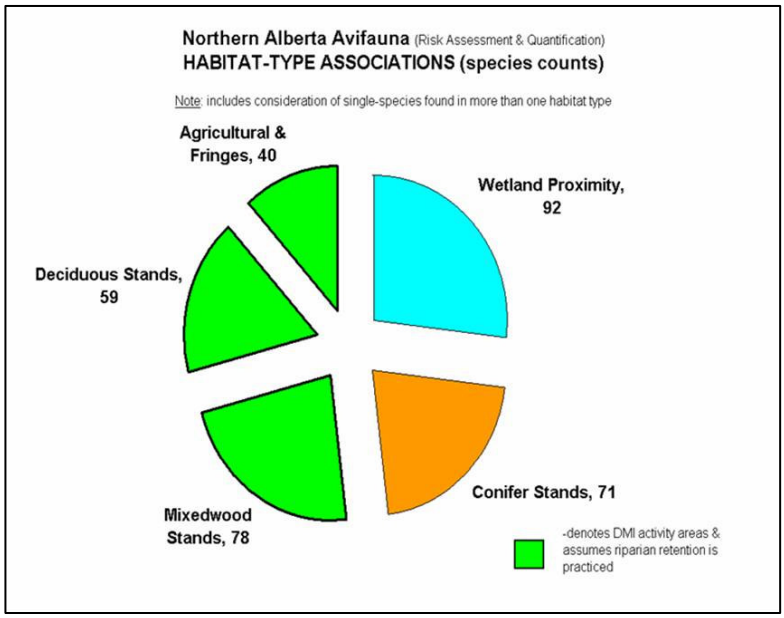


Figure 7.23 : Northern Alberta Birds –Habitat Associations

Nesting location preferences (Figure 7.24) are perhaps more diverse, and yet also reveal some species that might exhibit flexibility in nesting selectiveness that includes more than one location type. Those highlighted in green represent the proportion of species that generally nest in forests for which issues of their detection would present varying but distinct challenges in mitigating conflict with certain seasons of forest operation.

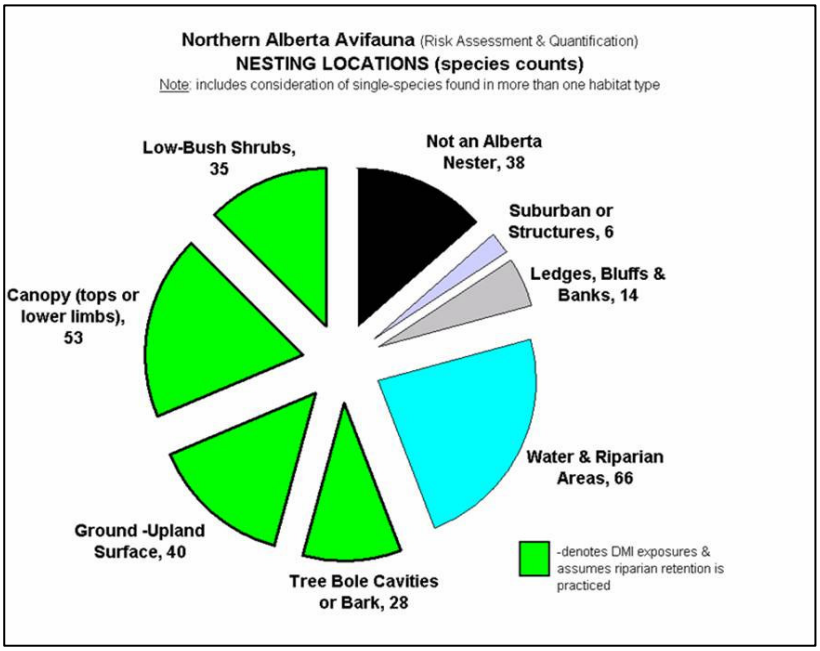


Figure 7.24 : Northern Alberta Birds –Preferred Nesting Locations

Perhaps one of the more challenging areas lies in avian vulnerability centering on the temporal aspect of their presence in boreal forests. Since most of the species are migratory, their diversity and resident populations fluctuate significantly by season within the DFA. Most of the seasonal diversity is held in species that arrive in the region for nesting and then depart during the arrival of autumn. Equal portions of others are resident year-round or merely migrate through the region to nest elsewhere. A small number over-winter in the region but nest further north in arctic or other regions. Figure 7.25 illustrates this temporal factor in local avian diversity.

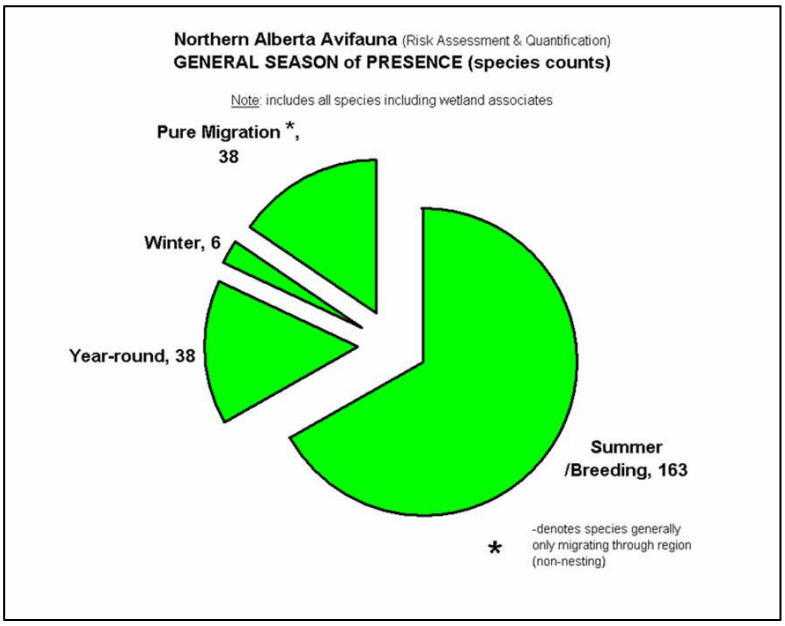


Figure 7.25 : Northern Alberta Birds –General Season of Presence

A filtered examination of species that are dominantly upland forest dependent species along with the general timing of their arrival and the period of nesting activity provides some indication of the specific periods of highest vulnerability during peak avian diversity within the region. This data was again drawn from a variety of Alberta sources. This is presented for all upland forests (Figure 7.26) and separately for particular forest cover types that are primarily the subject of DMI DFA activity (Figure 7.27). Peak avian diversity appears to typically occur in the region from the third week of April and lasting until late July to early August when post-natal dispersal is active as many birds begin to move to forest edge habitats.

It is this period of time and diversity of species that create circumstances of tremendous challenge for any industries operating within Canada's boreal forests, and for that matter all industries operating in general within proximity to nesting birds (e.g. agricultural, marine, mining, hydro). Federal Migratory Birds legislation originally designed in the early 1900's to facilitate management of game bird hunting controls, established a regulation basis for zero permissible impacts on birds and their active nests without specific authorizations. The past decade has seen some regulatory reforms and extensive dialogue seeking the means to update this legislation both to reflect the current context for bird population conservation efforts as well as industrial activities across Canada. National eco-region specific Bird Conservation Plans will be the anchor

point for guiding Best Management Practices, impact reduction strategies and any "incidental take" allowances that might evolve in the future.

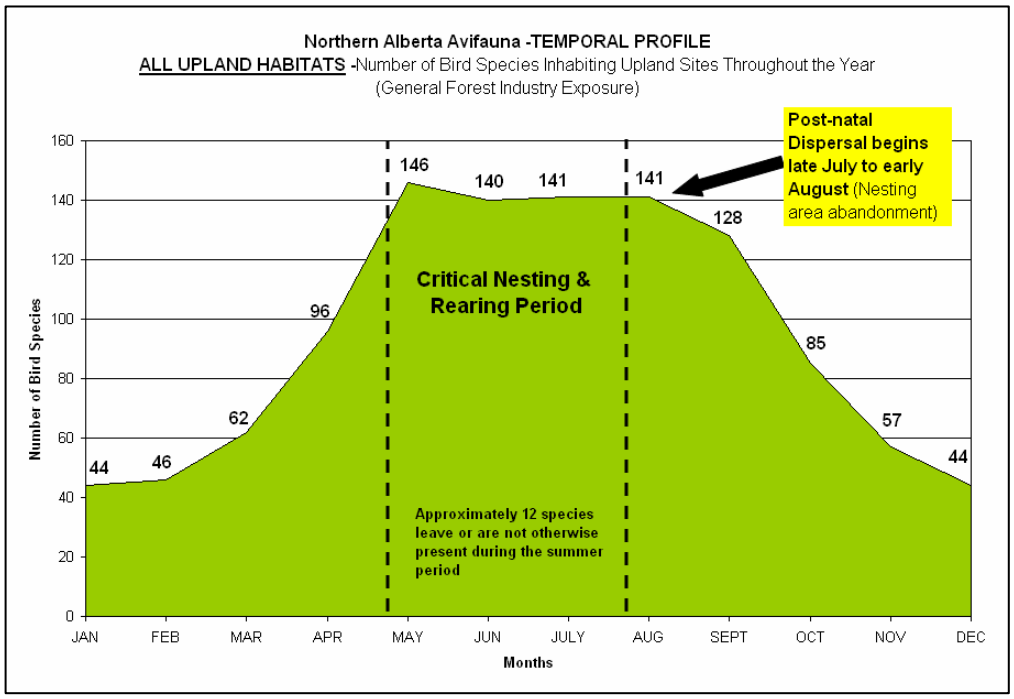


Figure 7.26 : Bird Diversity –Temporal Profile (monthly) –Upland All Forest

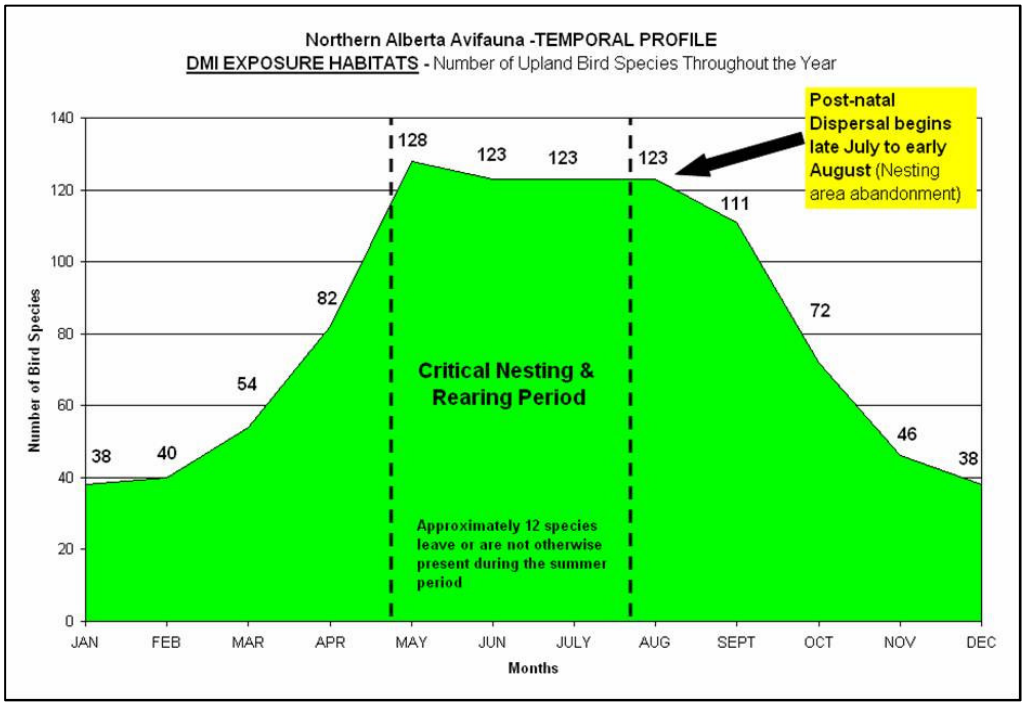


Figure 7.27 : Bird Diversity –Temporal Profile (monthly) –Upland Deciduous + Mixedwood

Avian species are regulated by a collection of provincial and federal legislation including the Alberta Wildlife Act, Canada Migratory Birds Act and Species at Risk Act. Of the bird species found in northwest Alberta, *The General Status of Alberta Wild Species 2005* report lists the Trumpeter Swan, Whooping Crane and Peregrine Falcon as species at risk in Alberta, while the Short-eared Owl and Red Knot are listed as species which "may be at risk". A large number of other species, including the Harlequin Duck, White-winged Scoter, Loggerhead Shrike, Black-throated Green Warbler, Western Grebe, Barred Owl and Sandhill Crane are listed as species of special concern. Two warbler species were in-process for higher status ratings (2010). Nationally, a number of other species are listed as species of various levels of risk; Common Nighthawk, Peregrine Falcon, Whooping Crane, Yellow Rail, Loggerhead Shrike, Canada Warbler, Olive-sided Flycatcher, Short-eared Owl.

Fiera (2010) noted the total profile of northwest Alberta bird species with some level of risk illustrated in Figure 7.28. In fact in the period between DMI's 2007 and 2010 reviews of sensitive species inventories, the number of northern Alberta avian species receiving mention as various levels of sensitivity have grown from 39 to 62 species. Fiera notes that to some degree this is a factor of ongoing effort among species designation organizations to assess species however it is also indicative of increasing sensitivity due to habitat loss in the wintering grounds of neo-tropical migrants.

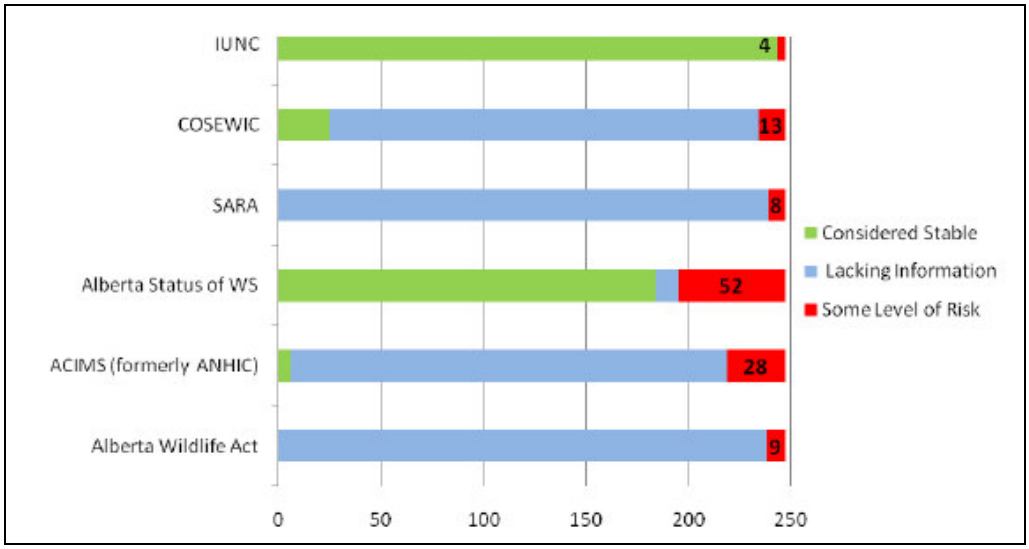


Figure 7.28 : Northwest Alberta High-risk Birds (Count by Agency -2010)

7.10.4.1 Trumpeter Swan

DMI tenures contain a well-documented but spatially-dynamic, widely dispersed collection of isolated and clustered locations of historical Trumpeter Swan habitat features. They exist regionally within both FMA and non-FMA landbases. Trumpeter Swans in the FMA area are geographically grouped by designated survey areas; Peace River, High Prairie.

Trumpeter swans (Cygnus buccinator) are the world's largest and rarest swan. Historically, they bred in boreal, parkland, and prairie habitats throughout Canada and the United States from James Bay to the Rocky Mountains, south to Missouri and

Wyoming. In Canada, trumpeter swans nested throughout the central regions of Alberta, Saskatchewan, and Manitoba, and along the James Bay coast of Ontario and Quebec. Although the total population size was unknown, the species was historically abundant. By the early 1900s, trumpeter swans were nearly extinct. Large numbers of birds had been shot for their down, feathers, and meat and increasing settlement had disturbed nesting areas. To save the trumpeters from extinction, an international program began in the 1930s as the birds and their remaining habitat were granted additional protection. The public was made aware of their status and was encouraged to report sightings of trumpeters or their nests and to reduce human activity near nesting areas.

Trumpeters have responded well to the restoration program. Populations in Alaska and the tri-state region of Montana, Wyoming and Idaho, have increased steadily to where these birds have been removed from the endangered species list in the U.S. Under the Alberta Wildlife Act, trumpeters are considered threatened. Swans are a seasonal occurrence within the boreal region, as they are a migratory species using the boreal region for summer range (breeding, nesting, forage during migration). Pairs may select and inhabit a wetland location for several years prior to nest initiation and breeding.[69] Certain lakes and wetlands have been documented to see annual traditional use during spring and fall migrations (stop-over sites). Identified nesting sites in and around the DFA, as shown in Figure 7.29. Local data has a problematic history in the accuracy of recorded points relative to actual water features, in some cases points discovered to include upland sites. Issues include the need for ground-truthing or screening of historical records, and error in conversions of ATS grid-centric data to lat—long coordinates, however Alberta has lacked capacity to efficiently resolve these issues.

[69] Alberta Trumpeter Swan Recovery Plan 2005-2010, Ab Species at Risk Recovery Plan No. 11, 2006

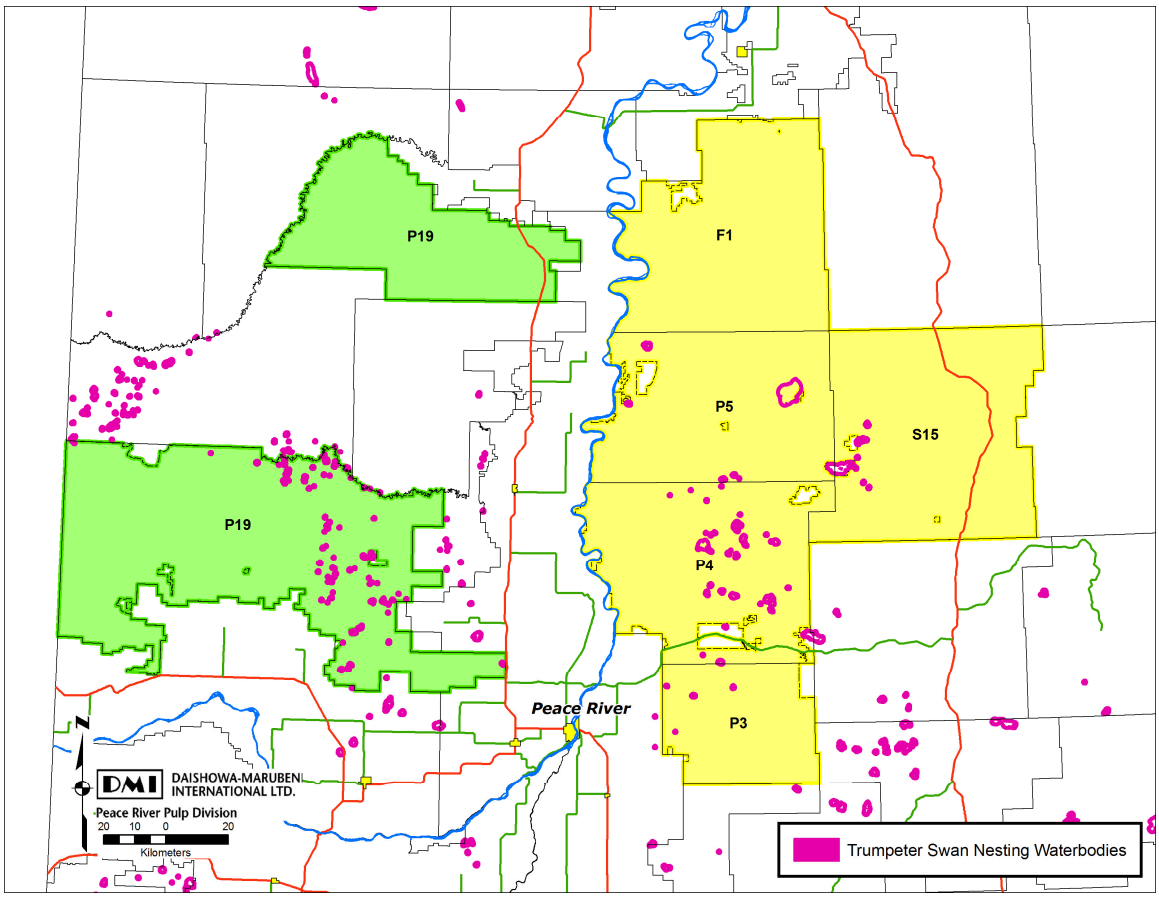


Figure 7.29 : Identified trumpeter swan nesting waterbodies.

Source : ASRD 2010

Trumpeter swans are not long-distance travelers; they fly only far enough to reach suitable habitats for nesting or wintering. They overwinter in the western United States and are found in Alberta only during the spring, summer and fall seasons. They require shallow lakes with an abundant supply of aquatic plants, insects, and snails (for nest sites and food). They also need protection from predators and human disturbance. Water levels must remain relatively constant during the summer and have minimal wave action or currents. Beyond breeding sites, resting and feeding sites during migration are critical to energy reserves for breeding. Swans have very strong ties to their nesting and wintering areas. Family groups remain together during migration, and the adults guide their offspring to the wintering areas. Nesting habitat locations see recurrent-use and multiple-year fidelity. Due to extensive daily forage intake (to 9kg), nesting habitat point locations see rotational-use along with staging, migration and moulting locations as the cycle of aquatic vegetation forage is depleted and then renewed over a period of years.

Nesting typically occurs near shore, on islands or muskrat/beaver lodges. Under severe repeated disturbance, permanent abandonment of breeding wetland locations, or reduced foraging and resting behavior at other non-breeding sites are both potential risks. Key determinants in habitat selection include; wetland size/depth, aquatic vegetation abundance (emergent, submergent), invertebrate abundance, water depth stability, water quality (un-polluted), potential nesting structure, low human disturbance.

Swans are highly territorial and will drive all other swans from the nesting lake. Thus, the usual density of breeding swans is one pair per lake, which helps ensure sufficient food for the adults and 5 to 6 cygnets throughout the summer. They use a variety of aquatic foods not used by other waterfowl. Their long neck and powerful bill allow them to extract deep roots and stems that other birds cannot reach. Adults eat up to 9 kg daily from a variety of aquatic plants, such as arrowhead, pondweeds, sedges, cattail, duckweed, and water moss. Swans often supplement their plant diet with a few large aquatic insects and snails. Very young cygnets feed on the surface, eating large aquatic invertebrates and often depending on the adults to stir up the water around them.

A major factor affecting Alberta trumpeter swans is the size of their wintering habitat, which is concentrated in a small portion of the Snake River in Idaho. In addition, they share this small area with migratory trumpeters from the Yukon, Northwest Territories, and British Columbia. Competition for food is so high throughout the winter that some birds are in relatively poor condition by spring. Exhausted energy stores in overwintering swans can lead to reduced migratory movement, egg laying, incubation success and survivorship. Overcrowding and concentration in one area also increases the potential for major losses from disease, parasites, or severe weather.

Human activity and disturbance in breeding areas may cause death of adult birds and/or decreased survival of eggs or cygnets. Trumpeter swans are sensitive to repeated disturbance and may refuse to nest or may abandon an existing nest when disturbed. Adults are most sensitive to disturbance from mid-April to mid-June, unfortunately when the eggs and cygnets are also at greatest risk. Swans will not nest on lakes intensively developed for recreation. They can nest on lakes near areas being developed for resources but only if increased access does not result in greater recreational use or other disturbance. Key species sensitivities that require management of human acitivites include: Sensory disturbance (sound, sight) during nesting season (April 1 to Sept 30), cover screening of riparian vegetation (long-range aquatic habitat quality and effectiveness), water quality (pollution prevention), water quantity (as a factor of road cross-drainage engineering and management) and awareness of species sensitivities (public, industry, agriculture sectors).

Management of land-use considering trumpeter swans in northwest Alberta has focused on protecting nesting lakes and minimizing disturbance during the nesting season (April 1 – September 30). Well-established historical forest practices largely exist in the form of regulator-defined guidelines on sensory disturbance avoidance and distancing for forest planning and activities in the vicinity of designated Trumpeter Swan habitat. These measures focus on minimizing access development near the designated sites, providing effective vegetation screening around them, and minimizing disturbance of the swans during the sensitive nesting period.

7.10.4.2 Raptors (hawks, owls, eagles, falcons)

The region hosts approximately 24 species of raptors, 12 of which are considered sensitive by various agencies and a number of which are considered migratory and therefore protected federally. It is widely accepted that sensory disturbance or physical impacts to active nests represent the two primary manageable risks that have ramifications to reproductive success. Nests for many raptors are generally large, located in the tops of large trees or snags and therefore readily detectable during industry operational planning. The structure of such nests tends to withstand wind forces beyond the year of construction.

Sensory disturbance risks to nesting raptor species can be effectively addressed by activity timing to avoid nesting seasons, although this may be difficult for all species since some owls are noted to breed locally as early as late-February to March.[70] Treed non-harvest buffers provide benefits in protection of the nest structure (breeding habitat), sensory disturbance prevention for nesting birds, thermal relief, and providing for tree-to-tree perch opportunity for fledglings to develop flight skills prior to post-natal dispersal. Canadian research and jurisdictional requirements defining effective buffer-size for raptor nests vary widely by jurisdiction and species. Even within Alberta, such site-level protection zones vary between the guidelines established for different industrial sectors (e.g. forestry, energy), as well as between species.[71] Such guidelines are rather new (circa 2008) in Alberta, and prior to that buffering tended to occur by voluntary industry practice. DMI has local anecdotal experience from design of harvesting practices on private land since the mid-1990's that suggest 60-meter radial buffers on occupied Red-tail Hawk nests appear to be effective screening distance that permits successful nesting and rearing of fledglings. Nesting bird sensitivity to sensory disturbance sources (e.g., road proximity) also appears to vary greatly between raptor species, with some local owl species observed nesting immediately adjacent to existing primary all-weather roads. Great Gray Owls seem to exhibit some tolerance for such traffic in forested areas.[72]

Literature on buffer-size for "unoccupied" (abandoned) nests is inconclusive, probably because it is species-dependent. A local informal DMI field survey (2005)[73] of sites deploying nest-protection practices since 1997 validated the continued value in buffering unoccupied raptor nests through observed evidence that some raptor species appear to be opportunistic in selection and re-use of existing nest structures that were constructed in previous years. It is not known whether these birds are returning to the same nests year after year.

7.10.5 Herptiles (Amphibians and Reptiles)

Northwest Alberta potentially hosts 10 species of herptiles, 7 of which are considered to be sensitive by various agencies. One species appears to be an historical record with little evidence of recurrence or confirmation that the species was resident or introduced (Western Painted Turtle).[74] For some species (i.e. Western or Boreal toad) northwest Alberta may represent the northern limit of their range, so habitat impacts may be particularly influential on these sub-populations.[75] The Long-toed Salamander and the Northern Leopard Frog are two species afforded mention in the Alberta Wildlife Act, and

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[70] 2007, Federation of Alberta Naturalists, -The Atlas of Breeding Birds of Alberta; A second look.
[71] 2010, Alberta. Upstream Oil and Gas Best Management Guidelines for the Enhanced Approval Process
[72] Personal observations –DMI, Witiw
[73] 2005., DMI., "Boreal raptor nests; A field survey of nest preservation and nest occupancy following forest harvest operations"
[74] 2000., Anthony P. Russell & Aaron M. Bauer. "The Amphibians and Reptiles of Alberta -A field guide and primer of boreal herpetology". ISBN 1-55238-038-6
[75] 2010, Eaton B., "Boreal toad habitat use and response to disturbance in the boreal mixedwood forest" (project report March 2010), Alberta Innovates –Technology Futures + 2010, Browne CL, "Habitat use of the western toad in north-central Alberta and the influence of scale", PhD thesis, UofA + 2007, Eaton B, -"The ecology of amphibians in the boreal mixedwood forest of northwestern Alberta: Amphibian use of the riparian zones of small streams and habitat use by the boreal toad" (Progress report for North American Waterfowl Management Plan Science Subcommittee -Alberta)

while their presence in the region is plausible, sightings have tended to be rare for uncertain reasons. The Canadian Toad is considered to be of may-be-at-risk status in Alberta. The Boreal Toad and Northern Leopard Frog are listed as special concern species in federal legislation (SARA). Figure 7.30 illustrates proportional diversity among northwest Alberta herptiles.

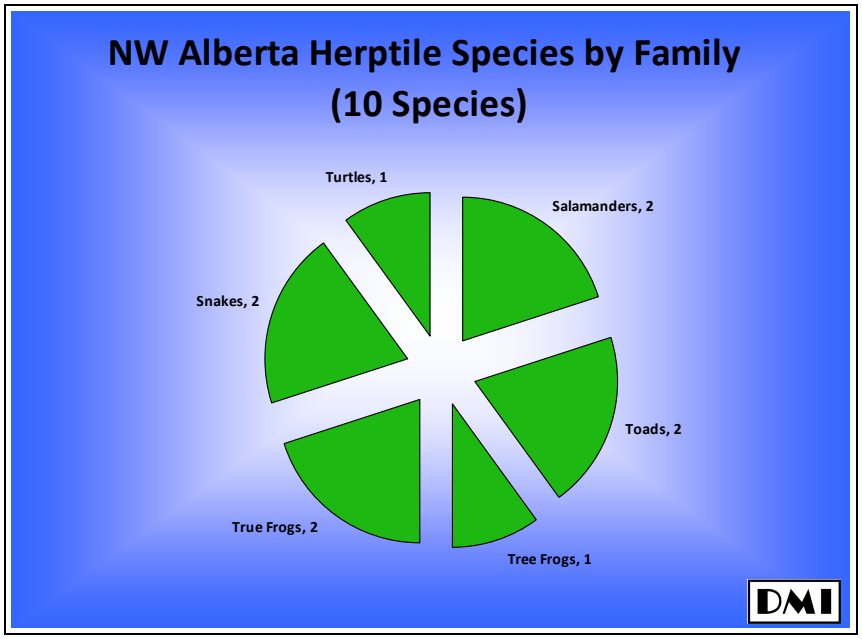


Figure 7.30 : Northwest Alberta Herptile Diversity

The mixedwood boreal forest contains an abundance of wetlands, small water bodies, various classes of flowing surface hydrology, riparian areas and dynamic water levels that collectively provide good breeding and rearing habitat for amphibians. These same areas provide tremendous habitat for the understory vegetation and many insects on which amphibians feed. The Peace River is also an important distribution route for amphibians (Roberts et al 1987).

The habitat needs of herptile species are dynamic or relatively complex, in that their needs vary between different life-cycle stages and seasons (reproduction, foraging, over-wintering).[76] Amphibians hold a particular vulnerability because they require both aquatic and terrestrial habitat to complete their life cycle.[77] Important focal points that are well-studied for their life-cycle value to herptiles include permanent aquatic habitat features (waterbodies, larger permanent watercourses) and associated riparian areas, as well as the importance of suitable hibernacula micro-sites for over-winter survival commonly needed among toads and two local Garter snake species.

Moisture (both upland micro-site moisture and aquatic habitat) is suggested to be important for many of these species at some point in their life cycle. These needs are

[76] Personal Communications 2006-2010: Dr. Brian Eaton, Aquatic Ecologist and herptile specialist, Alberta Research Council. + see 2010, Browne CL

[77] 2005, Trenham PC and Shaffer HB., -Amphibian upland habitat use and its consequences for population viability. Ecological Applications, 15: 1158-1168.

met through habitat use in proximity to water and riparian vegetative communities or otherwise in upland areas through dense vegetative ground-cover, downed-wood debris, leaf litter-layer and pockets of water refugia. Distinct water-quality attributes appear to be directly influential on breeding success for amphibians (i.e. partial canopy cover, adequate hydro-period, pH, warm temperature, emergent aquatic vegetation),[78] some of which might be manageable through ecological-based industry practices. Many amphibians prefer low to medium canopy cover on aquatic features for breeding as reflected in breeding productivity success.[79] This may provide water feature screening from evaporative effects of wind (hydro-period control), while yet allowing solar heating of water and positive conditions for emergent vegetation.

Although analyses of local boreal research was yet underway at the time of writing, it appears that some ephemeral watercourses and some ephemeral pocket wetlands (vernal pools) do commonly note amphibian presence and can support successful breeding depending upon factors of water quality, hydro-period and site qualities. A dependency on some landscape connectivity between permanent aquatic features appears to be important to amphibians,[80] because of their relatively poor dispersal abilities. Preliminary analysis of local research data suggests that lower order watercourses and adjacent land-corridors may be serving as dispersal pathways during May to August before amphibians move upland to overwinter (Eaton, Paszkowski).

Outside of aquatic habitat needs, DMI's initial consultations with herptile specialists[81] indicated that treed-canopy cover requisites (stand density) in uplands vary among these species. Some species (toads) may avoid sites with dense canopy cover, preferring locations of downed wood debris, open interface along stand-edges, aquatic-upland interface and areas of good ground vegetation cover as might occur in stand-voids, disease centers or stand break-up seral class (Eaton, Browne). Ground vegetation understory (shrubs, grasses and forb species) appears to be a common need for foraging, cover and temperature-regulation, although density requisites vary. During the fall to frozen-period, a number of amphibian species are documented to over-winter in upland areas. Leaf-litter may be important to frogs (Eaton), while toads are documented to rely on a variety of features for hibernacula; hummocks (peat, willow), red squirrel middens /caches, natural crevasses, decayed root channels, cavities under spruce trees, cavities or tunnels under rotting logs, sandy-soil or riparian-soil horizon, and structures created by beavers/muskrats.[82] Strong selection for spruce stands was

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[78] 2009, Personal communications (local research projects analyses + other Alberta amphibian research): Dr. Brian Eaton, Dr. Cynthia Paszkowski

[79] 2009, Wind E (E. Wind Consulting), -"Forest harvesting and the management of small wetlands and amphibian populations" (Conserving Wetlands in British Columbia May 2009, Columbia Mountains Institute of Applied Ecology) –citing works of Halverson MA et al 2003, Lauck B et al 2005, Skelly DK et al 1999, Werner EE et al 1999

[80] 2008, Eaton B, Bradbury S, Hiltz M., -"Riparian zones of small streams and wetlands in boreal Alberta: Are they important for herptiles, and can we use vegetative characteristics to detect them (herptiles) during timber harvest?", -Alberta Research Council (FRIAA progress report)

[81] Personal Communications 2006+2007; Dr. Brian Eaton, Alberta Research Council and Kris Kendell, Alberta Conservation Association.

[82] 2010, Browne CL, "Habitat use of the western toad in north-central Alberta and the influence of scale", PhD thesis, UofA + 2010, Eaton B., "Boreal toad habitat use and response to disturbance in the boreal mixedwood forest" (project report March 2010), Alberta Innovates – Technology Futures

noted for hibernacula sites, but open or deciduous forest during active (non-frozen) season. Browne observed that toads may hibernate more than 300-meters (to 1900m) from breeding habitat, so protection of breeding habitat alone is ineffective for species conservation. Similarly research in other jurisdictions has observed Boreal Chorus and Wood frog species using upland habitat at distances of 500-750m from breeding habitat.

Snake and toad hibernacula appear to represent rather uniquely sensitive features, since they are not necessarily associated with water features and can tend to house concentrations of individuals (Browne), thereby representing a risk to local sub-population losses if unprotected. Locally, snake hibernacula occur typically along arid unstable valley slope tops where fissures from past mass-waste events have stabilized and where sun exposure is positive. These sites see repeated long-term use over many years by those sub-populations that rely on communal over-wintering for survival. The 2 species of garter snakes in the region are particularly abundant along the Peace River and its tributaries where there is good over-wintering habitat, positive micro-site temperature conditions and an abundance of amphibians, a preferred food. Yet, documented snake hibernacula in the region are few (Alberta FWMIS). Garter snakes are also regularly observed inland some distances from these dominant waterways, suggesting they travel extensively during the summer period while traversing aspen parkland, open agricultural lands and forested areas.

Industry forest activity guidelines are at best early in their evolution within Alberta (circa 2008), partly because until recently western boreal-specific science on amphibian and reptile ecology has been largely very limited. Habitat considerations have tended to occur by voluntary industry practice. While it is clear that herptile life-cycle demands a variety of habitat needs (breeding sites, upland & riparian dispersal habitat, hibernacula), the definition of that habitat is less clear, but gradually forming within the boreal region.

Beyond the recognized value of waterbodies and permanent watercourses to herptiles, and some documented snake hibernacula, broader understanding of the behaviour, mobility and ecology of amphibian and reptile species in the northwest boreal mixedwood has until recently been largely understudied (distribution range, important habitat components, spatial patterns of landscape-use, forest structure value).[83] With regard to distribution for some species (i.e. Northern Leopard Frog, Tiger Salamander, Long-toed Salamander, Painted Turtle), northwest region sightings have been rare or highly speculative, so their true distribution is poorly known or limited to spot locations near major waterways and roads.[84] Hibernacula practices and micro-site characteristics for salamander species in the boreal region consequently represents another elusive gap in understanding.

Until very recently, the value and specific qualities of low order streams (ephemeral, intermittent and small-permanent watercourses) that dominate boreal landscapes as well as upland pocket wetlands (willow openings, vernal pools, ephemeral wetlands) in

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[83] Personal Communications 2006-2009: Dr. Brian Eaton, Alberta Research Council., + 2010, Eaton B., "Boreal toad habitat use and response to disturbance in the boreal mixedwood forest" (project report March 2010), Alberta Innovates –Technology Futures + 2007, Eaton B, -"The ecology of amphibians in the boreal mixedwood forest of northwestern Alberta: Amphibian use of the riparian zones of small streams and habitat use by the boreal toad" (Progress report for North American Waterfowl Management Plan Science Subcommittee -Alberta)

[84] 2000, Russell AP and Bauer AM., "The amphibians and reptiles of Alberta: A field guide and primer of boreal herpetology", University of Calgary Press

boreal plain ecozones were both understudied as they might pertain to herptile breeding habitat, drought-relief, movement corridors or foraging habitat.[85] Consequential research initiated by DMI (2006-2008) in collaboration with amphibian specialists at the University of Alberta and Alberta Innovates (formerly Alberta Research Council), is assisting now to close this particular gap as final analyses of 3-years field datasets are completed (eta 2011). Quantified assessment to reveal any relationships between distance from water's-edge, amphibian abundance (habitat-use) and dispersal (movement) is also pending local data analyses.

Currently Alberta's preliminary guidelines suggest that buffer practices for amphibian breeding sites (e.g. 100-meter) are necessary, yet this has not been validated and may not address the fuller suite of amphibian life-cycle needs. Quality breeding habitat (spatial locations) has not to-date been well defined. The prospect of vegetative species-community signatures that might reveal optimal herptile habitat is undetermined as a tool for detection during activity planning (e.g. distinguishing between high and low quality aquatic/riparian herptile habitat). Disturbance and change is clearly part of the northern landscape within which amphibians have persisted, whether that occurs through large-scale wildfire events or more localized fluctuations in watercourse aquatics (quantity, quality) through beaver activity. Yet little is understood about how local herptile sub-populations respond and persist through those natural disturbance agents. Nonetheless, such understanding in the analysis of natural disturbance regimes for riparian forest structure life-cycles might provide important mitigation clues for design of mitigation and conservation practices. Blanket exclusion of adjacent forest disturbances from all aquatic/riparian areas through landscape-wide static buffers may not be appropriate in the northern boreal region considering this landscape history context and the dynamic character of site-level aquatic features these species rely on.

7.10.6 Fish

Northwest Alberta fish fauna (35 species) is relatively impoverished when compared to other Provinces or to States of the Ohio-Mississippi drainage that may have more than 160 native species (Nelson and Paetz 1992). Yet, species richness in northwest Alberta is relatively high for the province's 61 species. Of the 12 fish families occurring in Alberta, 2 are not found in northwest Alberta - Acipenseridae (sturgeons) and Ictaluridae (catfish). Figure 7.31 illustrates proportional diversity among these northern species.

[85] 2008, Eaton B, Bradbury S, Hiltz M., -"Riparian zones of small streams and wetlands in boreal Alberta: Are they important for herptiles, and can we use vegetative characteristics to detect them (herptiles) during timber harvest?", -Alberta Research Council (FRIAA progress report)

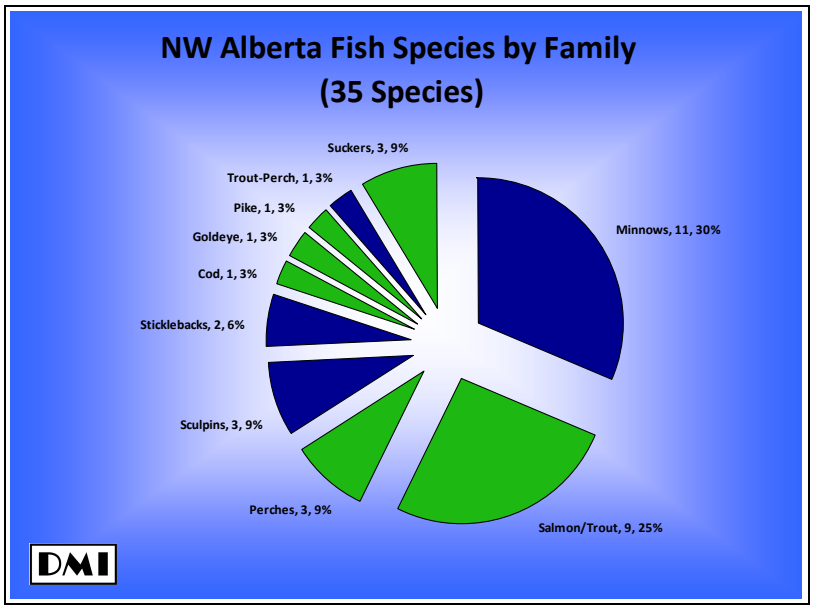


Figure 7.31 : Northwest Alberta Fish Diversity

Of the 35 species, half are forage fish (minnows, sculpins, sticklebacks, and trout-perch) that provide food for larger predatory fish. Nine species of the salmon/trout family represent almost another one-quarter of the fish diversity, while other game fish and suckers constitute the remaining species. Thirty-two species of fish are native to northwest Alberta, while three species (rainbow trout, eastern brook trout, and brown trout) have been introduced to enhance sport fishing opportunities. Two species were not included in the 35 because their presence in northwest Alberta is debatable; Shortjaw Cisco, Blackfin Cisco.

The diversity of fishes in northwest Alberta is related in part to the influence of three major drainage basins from which fish have dispersed into the area since the last glaciation: from the Peace/Fraser region, from the arctic, and from the Hudson Bay drainage to the east. Species richness is also affected by the diversity of habitat types in the many lakes and rivers found in this region. In particular, large river systems such as the Peace comprise a variety of habitats from the cold, relatively clear waters of its upper tributaries to the warm, turbid waters of lower portions and of the backwater channels and lakes of its active floodplain. Thus, cold-water fish, such as Arctic Grayling, trout, and Mountain Whitefish, spawn in upper reaches while other species spawn in lower reaches and in lakes. Three non-sport species of the region are uncommon in Alberta. The Largescale Sucker is found only in the Peace River system, while two minnows - the Northern Squawfish and the Redside Shiner - are only in the Peace system and are rare in Alberta.

Forage species tend to be the most abundant fish in the region's waterbodies (e.g., minnows, trout-perch, and sculpins). Amongst sport fish in fish-bearing lakes in northwest Alberta, Northern Pike is most frequently found, followed by Lake Whitefish, Rainbow Trout, and Walleye. Except for Lake Trout, members of the salmon/trout family are rarely found unless introduced. Species commonly observed in rivers and streams include Arctic Grayling, White Sucker, Lake Chub, Long Nose Sucker, Northern Pike, Brook Stickleback, Trout Perch, Finescale Dace, Longnose Dace, Burbot, Pearl Dace and Walleye.

Of the fish species found in northwest Alberta, no species are listed as species at risk in *The General Status of Alberta Wild Species 2005* report. The Rainbow Trout and Spoonhead Sculpin are the only species listed as species which may-be-at-risk (Rainbow Trout in-process 2010, Wildlife Act), while the Bull Trout and Arctic Grayling are all listed as special concern species (Wildlife Act). Federally, no local fish species are listed for protection, although a number represent assessment priorities for COSEWIC. The two species not included in the list of 35 (Shortjaw Cisco, Blackfin Cisco) are listed at federal at-risk species.

7.10.7 Invertebrates (Arthropods, Gastropods and similar)

Stelfox et al (Buddle, Hammond) dedicated extensive investigation and discussion in the 1999 *Biophysical* document on the state of knowledge and tremendous value of invertebrate communities to boreal forest ecosystems. That discussion largely remains relevant although the state of knowledge has advanced in many ways. That earlier work attempted to quantify these diverse and yet largely unmapped species. Stelfox noted that in 1989 only 12,000 insect species had been named in the boreal zone of Canada despite an estimated 22,000 species plausible. (Danks and Foottit, 1989) Figure 7.32 illustrates the proportional state-of-knowledge among arthropod orders in Canada.

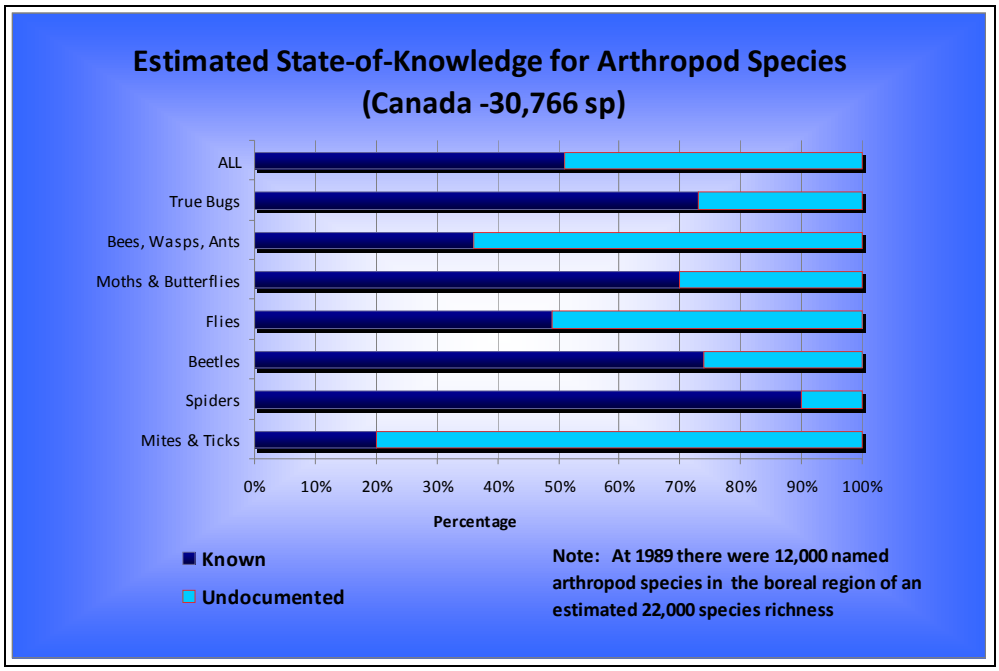


Figure 7.32 : Species Inventory Status –Canada Arthropods

In northwest Alberta, invertebrate inventories have been enhanced and expanded significantly through projects occurring in the EMEND research forest (Ecosystem-based Management Emulating Natural Disturbance) during the past decade as well as through other Alberta research, recent and emerging. In fact, northwest Alberta inventories of invertebrates have surpassed the 360 species count reported in the 2005 General Status of Alberta Wild Species, and may represent a first in Canada at the regional level (Spence 2010). Local inventories have grown to some 1287 species (16 gastropods,

1271 arthropods) and EMEND projects annually contribute new species discoveries to Canadian records. Invertebrate proportions within various orders are illustrated in Figure 7.33. This can be compared and contrasted with proportionate diversity spread among various orders within the known insect species across Canada (Figure 7.34).

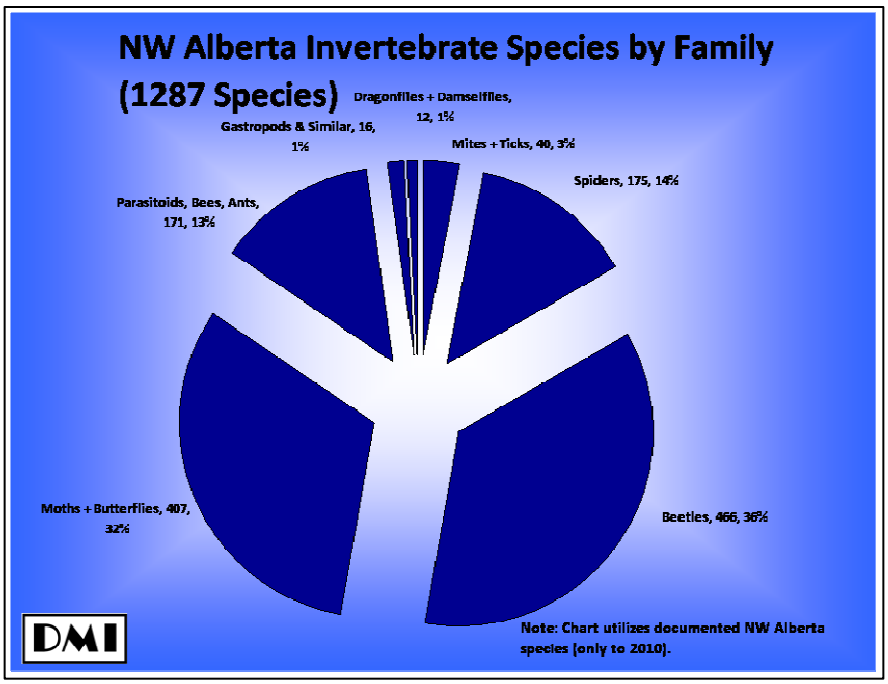


Figure 7.33 : Northwest Alberta Invertebrate Diversity (2010 status)

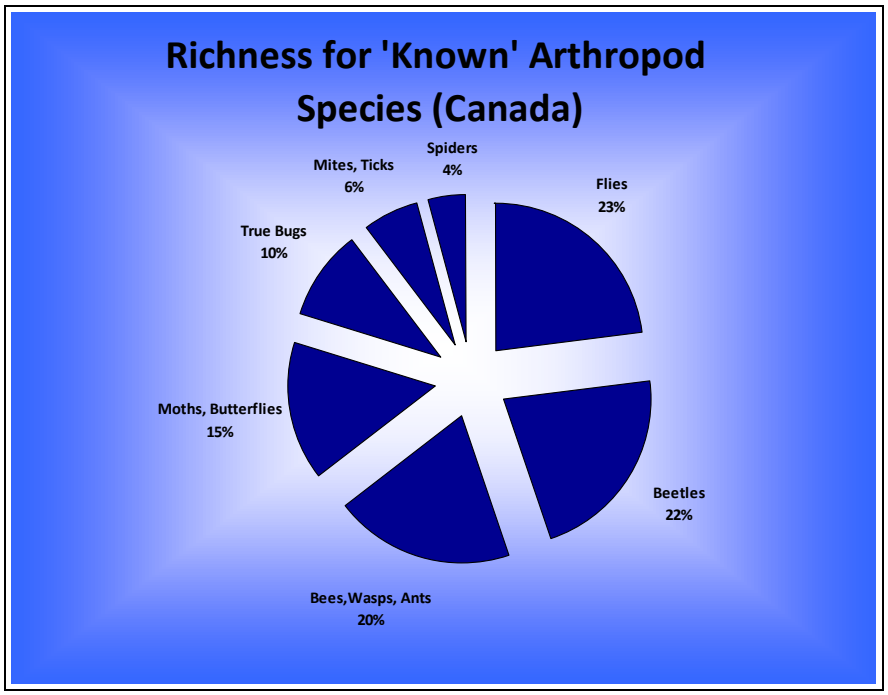


Figure 7.34 : National Insect Richness Among Known Species

Projects at the EMEND research forest have also been defining issues of rarity, roles in ecosystem function, inter-species relationships and habitat associations (forest structure, cover type, seral stage, vertical orientation, specializations). This is occurring both in defining baseline forest ecosystem diversity and in mapping their response (recovery, thresholds) to disturbance from wildfire and forest management activity. This research is providing fundamental understanding of foundational ecosystem processes and complexities that assist risk management in land-use decisions and forest management design. Insect communities represent critical influences in nutrient cycling, soil productivity, primary production (pollination) and food sources for many higher order species, and as such are arguably part of the core determinants in forest ecosystem dynamics and health. Yet their diverse numbers and cryptic existence renders them a unique risk and challenge that is often overlooked in discussions of biodiversity conservation, soil conservation and deadwood biomass.

Since forest invertebrates remain a rather young area of study yet, they are only beginning to see preliminary assessments for issues of rarity or species status. Nonetheless some species are starting to surface in the assessments of various biodiversity monitoring agencies. Local arthropod species noted to be of notable sensitivity include Lepidoptera (Gorgone Checkerspot, Monarch, Hudsonian Old World Swallowtail, Pike's Old World Swallowtail, Alberta Arctic). The Monarch appears on federal lists. Local gastropod species note 3 considered to be of sensitive status provincially.

7.10.8 Plant Communities (vascular plants, bryophytes, lichens, fungi)

Detailed discussion of the diverse plant communities found in northwest Alberta is contained in the 1999 *Biophysical* document. Except for the invertebrate communities, plants represent the second largest contribution to boreal species diversity in northwest Alberta. That earlier work to describe this has been enhanced and expanded through a variety of western boreal research in the past decade, most notably projects occurring on the EMEND research forest (Ecosystem-based Management Emulating Natural Disturbance). The 1999 species inventories have been greatly enhanced through EMEND work among vascular plants and all non-vascular groups (particularly bryophytes -mosses, liverworts). Figure 7.35 illustrates proportional diversity among plants in this region. It is anticipated this will continue to evolve as fungi species are inventoried further.

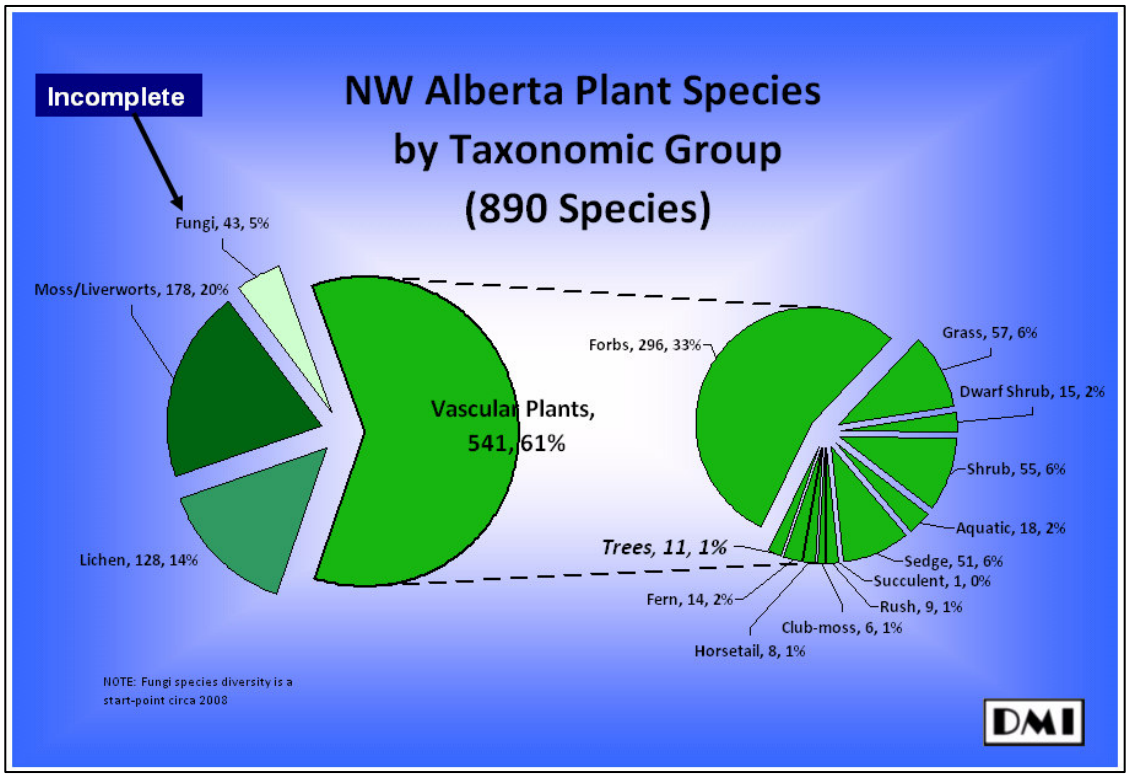


Figure 7.35 : Northwest Alberta Plant Diversity

Projects at the EMEND research forest have also been defining issues of plant rarity, ecosystem function, inter-species relationships and habitat associations (cover type, seral stage, moisture regime, density). This is occurring to define baseline forest ecosystem diversity and in mapping plant community response (recovery, thresholds, richness, species succession) to disturbance from wildfire and forest management activity. This research is also contributing to fundamental understanding of foundational ecosystem processes and complexities that assist risk management in land-use decisions and forest management design. Plant communities represent important factors in nutrient cycling, soil productivity, soil stability, hydrology regulation, litter habitat and food sources for many species, and are arguably therefore also a key determinant in forest ecosystem dynamics and health.

Understory plants are often understated in the attention they receive relative to higher-order species and tree species. Yet some argue that in terms of the relative value of bottom-up forces in trophic networks, the removal of higher trophic levels leaves lower levels intact if perhaps greatly modified, whereas the removal of primary producers leaves no system at all. (Hunter MD and Price PW, 1992) Key issues in biodiversity conservation for plant species appear to lie in the areas of soil conservation (micro-fauna, moisture, nutrient cycling, porosity), micro-site moisture regime, deadwood debris structure (horizontal, vertical, stage of decay), canopy cover (density, type) and stand seral stage. Close associations with invertebrate diversity and life-cycles appear important. Challenges of landscape scale and shear diversity mean that most of these habitat elements will need to be managed as coarse-filter strategies and beneficial management practices. Fine-filter strategies are only beginning to surface as species of rarity are identified, factors in their persistence revealed and forest stand associations clarified (e.g., bryophytes).

Relative to invertebrates, the plant kingdom has advanced quicker in the proportion of species assessed for status, although no local fungi have been assessed by any of the six species designation agencies. Alberta Conservation Information Management System (ACIMS) is further ahead than most other agencies in assessing status for vascular plants, lichen, moss and liverwort species. The Alberta Status of Wild Species project has evidenced improved comment on status among vascular plant assemblages. Most vascular plant species in this region are considered to be stable, with a notable number considered sensitive provincially.

Vascular plants noted as may-be-at-risk status provincially include: Small Bitter Cress, Wavy-leaved Chickweed, Spotted Joe-Pye Weed, Tall Blue Lettuce, Low Townsendia, Browned Sedge, Narrow Sedge, Fox Sedge, Pale Bulrush, Poverty Oatgrass, Little-seed Rice Grass, Slender Salt-meadow Grass, Yukon (Bodin's) Milkvetch, Slender Naiad, Grape Fern, Ground Cone, Mountain Bladder Fern, Purple Rattle. Only one plant species, a bryophyte (Hallers Apple Moss) is listed federally as a threatened species.

7.11 Government

The DFA is located entirely on crown land which belongs to the province of Alberta. The Forest Management Agreements (FMAs) between the government and DMI grant DMI the right to manage the area for growing and harvesting trees for the production of forest products. The Public Lands Act gives the province the authority to remove land from the FMA as required for other uses, such as road construction, research plots or for allocation to other industries.

7.12 Protected Areas and Parks

Protected areas and parks that fell within the boundaries of the Forest Management Units associated with DMI's FMA were removed from the FMAs and are therefore not available within this plan for operations. More detailed information on the protected areas and parks is located in Section 2.7 of this document.

8 References

Stelfox J.B and Wynes B. *1999. A Physical, Biological and Land-Use Synopsis of the Boreal Forest's Natural Regions of Northwest Alberta.* DMI Internal Paper. 918 pp. (http://www.dmi.ca/about_dmi/dmi_in_alberta/prpd/detailed_forest_management_plans/landscape_assessment.html)



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1 Project Description

1.1 Background

DMI first received a Forest Management Agreement (FMA) for Crown forest land in the Peace River area in 1989. FMA 8900027 defined a forest landbase that included parcels on both the east and west sides of the Peace River, north of the Town of Peace River.

DMI prepared a Preliminary Forest Management Plan in 1990 followed by Detailed Forest Management Plans in 1992, and 1999. A complete new DFMP complying with the 2006 planning standards was submitted in 2007 as a revision to the 1999 plan and approved in 2008. At the time of this submission, the 2007 DFMP spatial harvest sequence is the approved sequence. The 1999 Annual Allowable Cuts (AAC) are the approved harvest levels at the time of this submission.

FMA8900027 was cancelled in 2009 and replaced with two new FMAs. The first, FMA0900044, covers the Crown forest lands formerly known as the East part of FMA8900027. The second, FMA0900045, covers the Crown forest lands formerly contained within the West part of FMA8900027 with the additional area of the former Forest Management Unit P1N. The new FMU designation for the West FMA area is 'P19'.

This document details the modeling work completed for the West FMA (FMA0900045) in partial fulfillment of the 2006 Alberta Forest Management Planning Standard. The modeling work has a start date of May1, 2009 and forecasts the forest state 200 years into the future.

1.2 Document Scope

The complete DFMP submission will include the following segments:

- Technical documents explaining 'what', 'why', 'how' (meant for ASRD technical reviewers).
    - Net Landbase Documentation
    - Growth & Yield Information Package
    - Forecasting Documentation

- Descriptive documents explaining ‘what’ (meant for public review).
    - Targets & Implementation
        - VOITs
        - Road Corridor / Access Plan
        - Restate the Preferred Forest Harvest Sequence (PFHS) and AAC determination results from the *Forecasting Document.*
        - Forest Operations Systems
        - Silviculture Matrix
        - AAC Drain
        - Reporting and Monitoring
    - Landscape Assessment

This document presents the third technical stage of the DFMP submission. Specifically, it covers timber supply forecasting for FMA 0900045 (FMU P19). This documentation is intended to be of sufficient detail to allow ASRD to replicate the submission, consistent with Annex 1, Section 1.2(iv) of the Alberta Forest Management Planning Standard, Version 4.1 (“Planning Standard”).

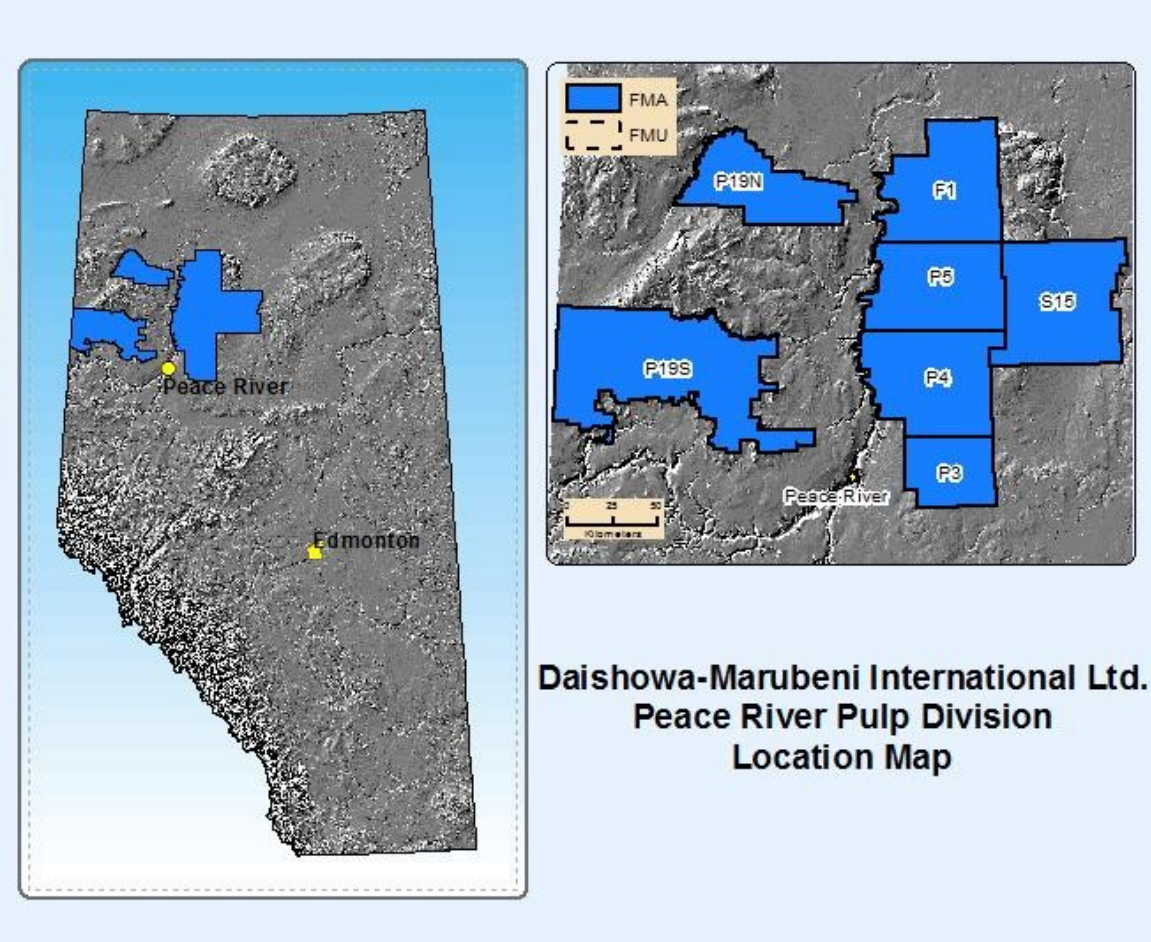


Figure 1. Location and Extent of DMI FMA Areas

The spatial and aspatial data is submitted through a digital ftp transfer. The data is available on DVD format disk upon request.

1.3 Overview of Timber Supply Analysis Process

The timber supply analysis (TSA) component of the DFMP is designed to ensure that forests are managed sustainably in the long term, consistent with Alberta's policy of sustainable forest management. The primary outcome of the TSA process is an Annual Allowable Cut (AAC), representing the maximum amount of timber that can be harvested each year while maintaining a complex array of other objectives and constraints. The approved AAC is based on the landbase available for harvesting and the forest management strategies applied to that land. Figure 2 provides an overview of the process to derive the AAC.

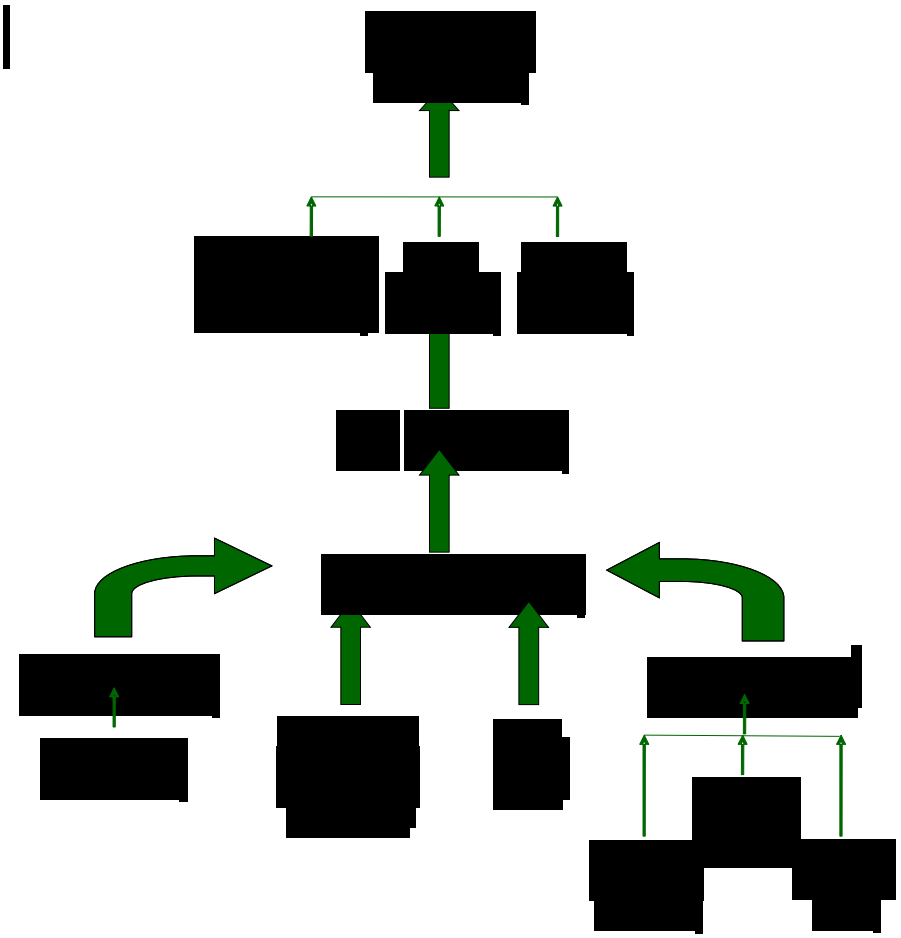


Figure 2. Overview of the Timber Supply Analysis Process

1.4 Net Landbase Determination

The May 2012 net landbase calculations had no numerical changes from the August 14 2011 submission. The following net landbase summaries are taken from the August 14 2011 submission

Net Landbase Documentation
Detailed Forest Management Plan 2009-2018
FMA0900045
(FMA West).

Table 1-1. Net Landbase Results for FMU P19

FMA WEST Net Landbase

	Treedarea(ha)	Polygon Count	Running Tally Treedarea(ha)	Running Tally Polygon Count
Gross Dataset	**959,552**	**366,272**	959,552	366,272
DELETIONS				
Indian Reserves / Settlements	0	0	959,552	366,272
Non-FMA	12,879	5,260	946,673	361,012
Swan Nesting Lake Buffer	5,784	2,444	940,889	358,568
Lake Buffer	4,859	3,708	936,030	354,860
Large Permanent Stream Buffer	2,061	1,296	933,970	353,564
Small Permanent Stream Buffer	10,198	13,572	923,772	339,992
Land Use Disturbance	9,238	54,183	914,534	285,809
Non Forest	61,905	27,756	852,629	258,053
Steep / Below Breaks of Incised Valleys	17,408	7,338	835,221	250,715
Black Spruce Non Productive	196,959	26,029	638,262	224,686
Subjective Deletions	33,514	9,761	604,748	214,925
Grazing Area	0	0	604,748	214,925
PNT and Research Area	629	859	604,119	214,066
Recent Burn	345	495	603,774	213,571
No Stratification	1,129	3,504	602,645	210,067
Private land	124	279	602,521	209,788
Removals: Non-merch	37	164	602,484	209,624
Total	**357,067**	**156,648**		
Net Landbase				
Conifer (LCIN) - Empirical Pathways	227,330	37,733	375,154	171,891
Conifer Sensitive Site (LCSEN) - Empirical Pathways	4,986	993	370,169	170,898
Conifer Empirical Total	232,316	38,726		
Conifer (LCIN) - Successional Pathways	111,544	68,650	258,624	102,248
Conifer Sensitive Site (LCSEN) - Successional Pathways	2,502	1,063	256,122	101,185
Conifer Successional Total	114,046	69,713		
Conifer - Net Landbase	**346,362**	**108,439**		
Deciduous (LDIN) - Empirical Pathways	5,048	1,502	251,074	99,683
Deciduous Sensitive Site (LDSEN) - Empirical Pathways	45	2	251,029	99,681
Deciduous Empirical Total	5,093	1,504		
Deciduous (LDIN) - Successional Pathways	234,871	93,506	16,158	6,175
Deciduous Sensitive Site (LDSEN) - Successional Pathways	11,601	2,636	4,557	3,539
Deciduous Successional Total	246,472	96,142		
Deciduous - Net Landbase	**251,565**	**97,646**		
EMEND	**4,557**	**3,539**	0	0
Total Net Landbase	**597,927**	**206,085**		

Net Landbase FMA WEST Formulation August 2011
Stratification version <FMA WEST> August 15, 2011

The net landbase reflects the expected forest condition on May 1, 2009. All known land use timber deletions have been incorporated. Industrial footprint has been removed from the forest and is assumed to be permanently removed in the dataset and related analyses. This will account for future new footprint withdrawals because reforestation, in fact, reduces the existing footprint somewhat. As well, future salvage volumes will be charged as production. These combined measures provide a very conservative approach to ensuring sustainability of the timber harvest.

1.5 Yield Curve Determination

This body of work uses the successional yield curves described in the September 13, 2011 submission entitled *Growth & Yield Information Package 2011*. This submission in May 2012 contains a revised version of that document dated February 2012 containing editorial changes requested by ASRD. The values on the curves themselves remain unchanged.

1.5.1 History

Following the first DFMP submission in 1999, Canfor, DMI, and Geographic Dynamics Corp (GDC) worked collaboratively to develop a refined yield curve set. The final product was a set of yield curves that model successional change within the white spruce – aspen mixedwood strata. The successional model was developed by GDC and is similar to the original DFMP yield curves in conceptual design.

GDC worked directly with SRD staff to develop the statistical regressions used. The final report was submitted in October of 2002 and conditionally approved in 2005. In October, 2008 the body of work was recalculated by Greenlink Forestry Inc. using new inventory data. The successional strata remained the same, with some changes to the stratification of non-successional strata.

SRD staff recommended that the yield curves be split for the new east and west FMAs. In addition, an inventory age adjustment was completed in 2010. These two factors were incorporated and the completed work was submitted in September 2011.

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2 Forest Management Approach

The forecasting efforts presented here are primarily completed to assist the forest managers in making informed decisions that are aimed at producing pre-determined forest benefits. The recipient forest managers are making decisions that affect their business operations and the general state of the forest now and in the future. The unique combination of inputs and controls formulated here capture the composite decision making aspects identified through the VOIT process and business planning process.

This plan is an implementation of state-dependant planning. There are explicitly defined future forest state targets set in the model. There are explicitly stated predetermined business targets set (timber cost, quality, and quantity). Indirect control measures are also present – for example the core-contingency model used to manage timber cost and ensure non-timber sustainability.

2.1 Ecosystem Management

This plan is formulated to achieve the benefits of ecosystem-based management. The general concept is to proactively maintain forest structure in the managed landscape similar to that of the natural landscape. This plan is the third evolution of the EBM approach by DMI. Like the previous two plans, DMI carries on here, implementing the basic components of EBM within its direct control:

- Maintain the building blocks of the natural forest at the landscape level
  - Achieved through landscape targets (BCGRP / Seral Stage combinations)
- Maintain a diversity of opening sizes and shapes
- Identify and protect special features
- Follow protective ground rules and use best practices
- Maintain natural structures at the stand level
  - Achieved through representative retention
  - Achieved through protective ground rules and best practices

2.2 Business Management

This plan strongly ties strategic forest management to shorter term business management. Extensive efforts have been used to select a sequence of actions that meet business needs while also meeting the EBM needs.

The single largest focus is on balancing the timber supply's cost / quality / quantity. It is explicitly identified that Annual Allowable Cuts have a context founded in cost-quality-quantity combinations. Directly defining quantified targets addressing these three aspects will produce a sequence that will have a far greater chance of being implemented than strategic plans in the past.

2.2.1 Preschedule

DMI, Canfor, and Zavisha (3 out of 4 tenure holders within P19) chose to select 10 years of harvest blocks for prescheduling. All companies started with the spatial sequence from the 2007 DFMP and ground truthed their selections. Canfor and Zavisha significantly added to the pool of stands by identifying at-risk merchantable pine stands. In the end, the conifer preschedule constituted a surge cut that will capture the pine beetle at-risk stands before they die and become un-useable.

DMI selected a mix that included non-frozen operable ground and winter operable ground. All companies considered likely access for the next 10 years. The final preschedule represents a collection of blocks that have been vetted by their respective operators and confirmed to be merchantable and affordable.

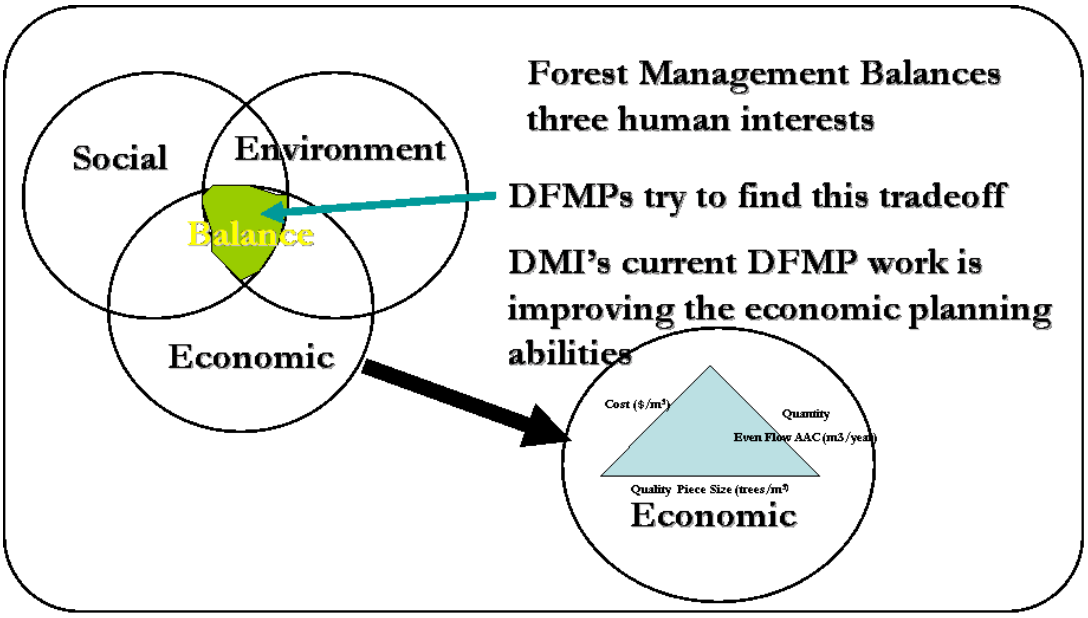
It is the goal of the operators selecting the preschedule stands to have minimal variance over the first 10 years of the plan.

The modeling exercise amended the first round of picks to ensure sustainability. Some blocks were moved to the 2nd ten year period.

Tolko opted to not pre-block. Their cut is relatively small concentrated in a relatively small area. The model picks a schedule of stands not unlike a manual selection would – there are not a huge array of options. Tolko will manage to the 20% variance allowance.

2.2.2 Core-Contingency

Forest management seeks a schedule of activities and practices that balance the social, environmental, and economic needs of stakeholders. The plan contains many VOITs addressing environment and social. Companies' practices and TSA constraints define the economic requirements.



DMI has made a major effort in this DFMP to strengthen economic decisions. Unprecedented cost pressures in recent years have forced DMI to seek innovative ways to stay in business. This TSA incorporates one such idea: Core Supply.

Core Supply is defined as those stands of sufficient quality available for harvest at a desirable cost. Everything else is considered Contingency Supply. This is composed of merchantable stands that because of cost or quality are second choice – DMI will use them when they have no alternative or during good economic times. This reflects a theoretical business model that is practiced by every company. The difference with this TSA is that DMI is partitioning the AACs so as to pre-calculate sustainable levels of each. If and when DMI uses Core supply only, this plan will have ascertained the sustainable AAC of Core. When DMI needs the Contingency supply, a sustainable plan is in place to harvest it. If DMI chooses not to harvest contingency in any given year, then Alberta may permit the wood to other companies willing to follow the DMI DFMP. This arrangement provides the best possible outcomes for community stability.

Partitioning the AAC into Core/Contingency precalculates sustainable plans for DMI's future whatever the economic conditions hold. It is an honest, transparent forecast of possible business outcomes. By implementing Core/Contingency, DMI solidifies its economic position in advance.

Core and contingency are predefined before Woodstock modeling based on company goals. Quality was defined using operability ages as a proxy (small wood is lower quality). Cost is the overriding factor. It is defined in $2 haul cost cycle categories to appropriate mill locations.

2.3 Planning Level Linkages

The planning standard checklist item 2.2.7 asks for a demonstration of linkage between operational and strategic planning. This plan is linked to operations in many ways:

1. All known 'on-the-ground' activities are spatially input to the forecasting model with the best available representation
2. The preschedule has been vetted to ensure it is merchantable and affordable.
3. Tactical and operational considerations (eg road conditions, summer vs winter ground, concentration of activities, integrated operation possibilities) were used to select stands entered into the strategic model.
4. Strategic model parameters are selected to emulate operational considerations in order that the model selected stands have a high probability of being operated without variance.
5. Variance is tracked and adjustments made.
6. The spatial harvest sequence is considered the pool of eligible stands to select from. The companies commit to using them and minimizing variance.
7. Core-Contingency segregated AACs are implemented.

2.4 Harvest Flows

P19 is an amalgamated unit with two Volume Supply Areas (VSA). The north half (formerly FMU P10) is called VSA1. The south half (formerly P1N & P13) is called VSA2. Deciduous cuts are even flowed across both VSAs. Conifer cuts are even flowed separately for each VSA. The following AACs are determined with this forecasting formulation:

- Evenflow Primary Deciduous Core for entire forest
- Evenflow Primary Deciduous Contingency for entire forest
- Evenflow Primary Conifer Core for VSA1
- Evenflow Primary Conifer Core for VSA2
- Evenflow Primary Conifer Contingency for VSA1
- Evenflow Primary Conifer Contingency for VSA2

Secondary cuts are not even flowed at the wish of the industry stakeholders. The actual allocation of volume and spatial blocks is defined in detailed volume supply agreements between the companies. This forecasting section presents only the calculation of cuts. The allocation is detailed in the *Targets and Implementation* document.

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3 Forecasting Model

3.1 Remsoft Spatial Planning System

Established in 1992 and located in Fredericton, NB, Remsoft is dedicated to the creation and support of software for integrated, spatial forest management planning. Its flagship products – Spatial Woodstock™, Stanley™ and the Allocation Optimizer™ are collectively referred to as the Remsoft Spatial Planning System (RSPS). This system is used by companies in the forest industry and leading public agencies and interest groups throughout North America, Australia, New Zealand and Southeast Asia for a host of different strategic and tactical planning issues (Remsoft 2005). This software lets you make resource allocation decisions that meet commercial objectives while ensuring the trade-offs from timber and other non-timber resources are assessed and considered. In the DFMP analysis for each Forest Management Unit, the RSPS (without the Allocation Optimizer) was used to forecast sustainable harvest volumes.

Spatial Woodstock is used for strategic-level planning and is designed to address forest management planning questions. It is a user-defined model that is commonly used to estimate expected harvest volumes over time and to assess trade-offs from other values and objectives. Spatial Woodstock also allows the user to define a wide variety of expected output levels such as growing stock volumes, harvested areas, age class distributions, and many others. Spatial Woodstock provides the spatial connection between Woodstock and Stanley and is used to create the area files (landbase to be modeled) and to generate time specific spatial characteristics of the land base.

Stanley is a tactical-level planning tool that is used to define both where and when the timber volumes projected with Spatial Woodstock will be harvested. Unlike Spatial Woodstock, Stanley is a simulation-based spatial activity allocation model. Stanley takes the planned blocks created from the harvest planning team, as well as the Spatial Woodstock schedule, and spatially allocates the schedule subject to a variety of spatial constraints.

RSPS version 2011.03 was used in this Timber Supply Analysis.

3.2 MOSEK

MOSEK was established in 1997 by Erling D. Andersen and Knud D. Andersen and it specializes in creating advanced software for solution of mathematical optimization problems. In particular, the company, based in Copenhagen, Denmark, focuses on solving linear, quadratic, and nonlinear convex optimization problems. MOSEK is a provider of optimization software which helps the customers to make better decisions. The customer base consists of financial institutions and companies, universities, and software vendors, among others (MOSEK, 2005). MOSEK is a commercial partner of Remsoft.

MOSEK optimization tools version 6.0 was used in this Timber Supply Analysis.

3.3 Modeling Process

This report will discuss the results of the west side FMA (FMU P19) analysis.

The primary input to RSPS is a shapefile of the gross landbase. Through the landbase netdown process, shapefiles are created for the SYU, complete with themes, ages and pre-block information (refer to the Net Landbase Documentation for more information on the creation of RSPS shapefiles). Data dictionaries for the Woodstock shapefiles are presented in Section 10.

The modelling approach used in this analysis followed the pathway shown in Figure 3. Overview of the Modeling Processbelow and described in detail in the following sections.

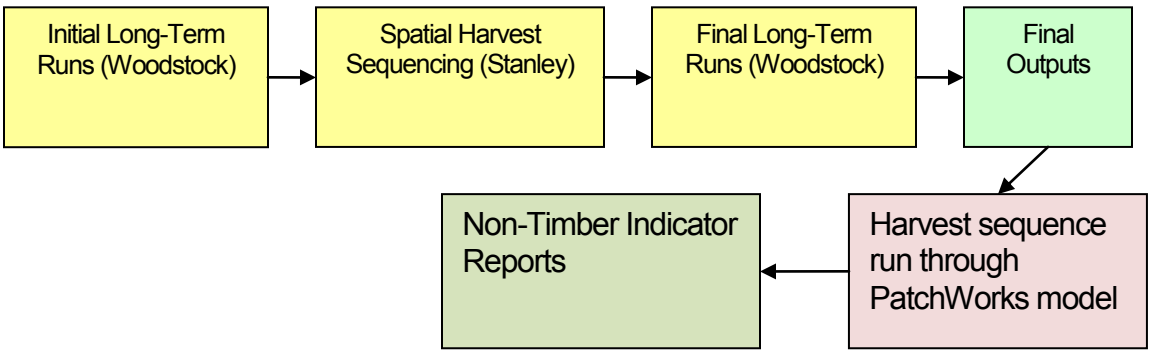


Figure 3. Overview of the Modeling Process

3.3.1 Initial Long-Term Runs

The Woodstock model was designed to achieve the maximum harvest volume within the constraints for operability and sustainability of both timber and non-timber resources. Yield relationships were applied to specific forest types (or yield strata) over a 200-year planning horizon. Harvest activities were applied to the forest based on specified objectives and parameters such as minimum harvest age, and minimum merchantable volume. Woodstock created a matrix of the Linear Programming problem (the collection of the objective function and constraints, in consideration of the land base, yield curves, and other management protocols). The linear optimization solver, MOSEK, was used to solve the matrix, returning an optimized harvest schedule to Woodstock. Woodstock then used this harvest schedule to calculate various outputs over the planning horizon.

3.3.2 Spatial Harvest Sequencing

Stanley, the spatial harvest scheduling component of RSPS, spatially allocates the Woodstock schedule to specific polygons on the landbase subject to spatial modeling parameters. Stanley creates blocks in order to achieve the aspatial volumes generated in Woodstock. Following a period of time when there appears to be no “better” solutions created, the model is stopped and the spatial allocation is written to the shapefile (a storage format for storing geometric location and associated attribute information). Maps of the areas scheduled for the 20 year Spatial Harvest Sequence (SHS) were generated with ArcMap. The harvest design will be used operationally for the first 10 years and somewhat less for the following 10 years..

Harvest mapping ensured that forest/landscape pattern constraints were met over the first 70 years of the planning horizon. Hardwood and softwood harvest objectives were blocked simultaneously in Stanley.

3.3.3 Final Long-Term Runs (Spatial Playback)

The preferred SHS produced by Stanley was incorporated into the long-term Woodstock run, providing a direct linkage between the operationally feasible SHS and long-term sustainability. The aspatial harvest schedule after year 70 was re-optimized to account for allocations made by Stanley in the first 70 years of harvest.

Woodstock was then used to re-calculate the outputs based on the SHS developed using Stanley. This schedule considered both the operationally planned blocks (preblocks) as well as the Stanley generated openings. This tactical level sequence then became the “hard-wired” sequence for the tactical portion of the final Woodstock run. Woodstock was re-optimized to calculate the

final values of the indicators defined in the model. To ensure additional blocks were not sequenced in the first tactical portion of the planning horizon over and above the SHS, the Woodstock model was specifically excluded from taking any additional actions during the tactical planning horizon. All model outputs displayed herein are based on this harvest schedule unless otherwise specified.

3.4 PatchWorks Simulation

A new DFMP for the east FMA (FMA 0900044) has been developed concurrent with the west FMA DFMP process. The east DFMP process utilizes the PatchWorks modeling system based on the same Woodstock formulation described herein. The east FMA PatchWorks formulation included a very convenient method for forecasting several non-timber indicators required by the planning standard.

A west FMA formulation of the Patchworks model was built containing all relevant inputs from the west FMA Woodstock formulation (eg yields, transitions, constraints, etc). The final spatial playback west FMA sequence was forced through the PatchWorks model in a simulation mode. The sole purpose of the simulation run was to produce the following spatial measures and associated maps in a rapid manner:

- Disturbance Patch Size
- Recent Disturbance Patch Size
- Interior Old Forest Distribution
- Seral Stage by Cover Class Distribution
- Seral Stage by Broad Cover Group
- Harvest Block Shape Index
- ECA Watershed Indicators

3.4.1 Patchworks Model Development

The Patchworks model was developed from the Woodstock model that was used for the TSA analysis. The standard set of Patchworks tools were used to complete the conversion:

- The 'Woodstock to Patchworks' translator was used to convert the Woodstock model input files into a Patchworks ForestModel XML file. A few minor changes were made to the Woodstock model (e.g. the addition of several haul zones) prior to conversion. No other adjustments were required.

- The modeling data base was built using the Patchworks 'Matrix Builder' program. The primary inputs were the composite forest inventory and the ForestModel XML file (as developed in the previous step). The composite forest inventory identified the spatial locations of each stand, and the 'CMPKEY' field was used to uniquely identify each polygon.
- The forest roads layer was updated with destinations for DMI, CanFor, Zavisha and Tolko – High Level. The road layer recorded cycle times based on average haul speed classified on each road segment, plus 1.25 hour turn-around time for conifer loads, and 1.75 hour turn-around time for hardwood loads. Cycle times were converted to costs using factors of $122/hour, 49m3/load for conifer, and $117/hour and 55m3/load for hardwood. The Patchworks 'BuildSegments' program was used to convert the GIS road file in to a Patchworks road dataset.
- In the Patchworks model, accounts summarize the change in stand-level attribute values. Reports can be created to summarize and display the contents of the accounts. A PIN file (Patchworks Input File) was developed to describe how to load the model data sets and components. Account and report descriptions were added to the PIN file to produce the required spatial indicators.

The resulting Patchworks model was built off of the exact same composite forest inventory as was used in the TSA modeling. All Patchworks modeling attributes were automatically created from the same Woodstock modeling input files as used in the TSA analysis.

3.4.2 Spatial Harvest Sequence in Patchworks

The TSA process using Woodstock and Stanley produced an 80-year spatial harvest sequence. (the 8th ten year period is not used – it helps to have it within scope in order that Stanley select a good solution for period 7. In all cases, the 8th period appears on charts but is to be ignored for practical purposes). This sequence identified the polygons that should be harvested in each planning period in order to generate the strategic level outcomes. At this stage of the analysis, Patchworks was used to assist in generate some of the spatial indicators required for this DFMP document. The process used to carry out this step was as follows:

- The final spatial playback spatial harvest sequence (SHS) from Nov 24, 2011 file from Woodstock was used as the basis to create a Patchworks schedule file. This file describes the blocks to be harvested, the year of harvest and the type of harvest treatment to be applied.

- The Patchworks model was started up with initial conditions of no harvest activities, and then the SHS schedule file was loaded. At this point the Patchworks model contained a simulation of the first 80-years of the SHS, followed by no harvest for the remainder of the planning horizon.
- A Patchworks model scenario folder was saved, containing all of the defined reports including the patch metric reports. Post-post-processing was carried out to generate interior core area data sets and reports.

3.4.3 Definition of Patches and Map Data produced in Patchworks

Generally, a patch in the Patchworks model is a connected set of topologically adjacent polygons, with all polygons in the set having a value for a specified patch membership criterion attribute that is greater than a specified threshold level. The following section summarizes the patches defined for the West Side spatial reports.

3.4.4 Disturbance Patch Definition

The 'disturbance patch' definition is based on harvest activity and the criterion for patch membership is a simple presence/absence test; has the block been harvested within the planning period (10 years) or not. If this test is true the harvested block is eligible to become a member of a harvest patch with topologically adjacent polygons in the dataset at a threshold search distance of 100m.

The total hectares of disturbance are tracked in Patchworks but can also be classified by a range of defined size classes. The following Patchworks patch accounts were defined in the model to track harvest disturbances by size range.

Table 3-1. Patchworks harvest disturbance account definitions.

Size Class (ha)	Patch Account	Patch Sub Accounts
0 – 5 ha	patch.harvest.0_5	patch.harvest.0_5.area patch.harvest.0_5.attractor patch.harvest.0_5.freqpercent patch.harvest.0_5.frequency patch.harvest.0_5.shape patch.harvest.0_5.size
5 – 10 ha	patch.harvest.5_10	patch.harvest.5_10.area patch.harvest.5_10.attractor patch.harvest.5_10.freqpercent patch.harvest.5_10.frequency patch.harvest.5_10.shape patch.harvest.5_10.size

10 – 50 ha	patch.harvest.10_50	patch.harvest.10_50.area patch.harvest.10_50.attractor patch.harvest.10_50.freqpercent patch.harvest.10_50.frequency patch.harvest.10_50.shape patch.harvest.10_50.size
50 – 100 ha	patch.harvest.50_100	patch.harvest.50_100.area patch.harvest.50_100.attractor patch.harvest.50_100.freqpercent patch.harvest.50_100.frequency patch.harvest.50_100.shape patch.harvest.50_100.size
100 – 250 ha	patch.harvest.100_250	patch.harvest.100_250.area patch.harvest.100_250.attractor patch.harvest.100_250.freqpercent patch.harvest.100_250.frequency patch.harvest.100_250.shape patch.harvest.100_250.size
250 – 500 ha	patch.harvest.250_500	patch.harvest.250_500.area patch.harvest.250_500.attractor patch.harvest.250_500.freqpercent patch.harvest.250_500.frequency patch.harvest.250_500.shape patch.harvest.250_500.size
500 + ha	patch.harvest.500_plus	patch.harvest.500_plus.area patch.harvest.500_plus.attractor patch.harvest.500_plus.freqpercent patch.harvest.500_plus.frequency patch.harvest.500_plus.shape patch.harvest.500_plus.size

The information regarding harvest disturbances was output from the Patchworks model to be used to map harvest disturbance by size class for the final DFMP of the West Side. The following information was output from the Patchworks model:

- Polygons with disturbance patch size attribute value > 0 were output for Period 1 (10 year), Period 2 (20 year) and Period 5 (50 year).
- Each polygon was labelled with the CMPKEY and the size of the disturbance they were a member of and this information was used to numerically classify the disturbance for each planning period represented when joined to the original composite landbase file.
- A histogram of the percent area distribution for the size classes was created for each of the planning periods as well as the area (ha) within each size class.

3.4.5 Recent Disturbance Patch Definition

To help map the landscape scale biodiversity indicators and demonstrate a distribution of harvest patch sizes on the landscape, a recent disturbance patch was defined. The recent disturbance patch criterion is similar to the harvest disturbance patch however includes operable stands that are less than 20 years old (therefore stands that were harvested in the previous planning period and those in the current planning period). Only polygons on the active (managed) landbase, and only those stands whose age is less than 20 years due to harvest disturbance (succession breakup to a younger age does not make a polygon eligible for a recent disturbance) are eligible for membership of the recent disturbance patch account. The threshold search distance for neighbours is 100m. The same disturbance size ranges were used for recent disturbances.

Table 3-2. Patchworks Recent Disturbance Patch account definition.

Size Class (ha)	Patch Account	Patch Sub Accounts
0 – 5 ha	patch.disturbance.0_5	patch.disturbance.0_5.area patch.disturbance.0_5.attractor patch.disturbance.0_5.freqpercent patch.disturbance.0_5.frequency patch.disturbance.0_5.shape patch.disturbance.0_5.size
5 – 10 ha	patch.disturbance.5_10	patch.disturbance.5_10.area patch.disturbance.5_10.attractor patch.disturbance.5_10.freqpercent patch.disturbance.5_10.frequency patch.disturbance.5_10.shape patch.disturbance.5_10.size
10 – 50 ha	patch.disturbance.10_50	patch.disturbance.10_50.area patch.disturbance.10_50.attractor patch.disturbance.10_50.freqpercent patch.disturbance.10_50.frequency patch.disturbance.10_50.shape patch.disturbance.10_50.size
50 – 100 ha	patch.disturbance.50_100	patch.disturbance.50_100.area patch.disturbance.50_100.attractor patch.disturbance.50_100.freqpercent patch.disturbance.50_100.frequency patch.disturbance.50_100.shape patch.disturbance.50_100.size
100 – 250 ha	patch.disturbance.100_250	patch.disturbance.100_250.area patch.disturbance.100_250.attractor patch.disturbance.100_250.freqpercent patch.disturbance.100_250.frequency patch.disturbance.100_250.shape patch.disturbance.100_250.size
250 – 500 ha	patch.disturbance.250_500	patch.disturbance.250_500.area patch.disturbance.250_500.attractor

		patch.disturbance.250_500.freqpercent patch.disturbance.250_500.frequency patch.disturbance.250_500.shape patch.disturbance.250_500.size
500 + ha	patch.disturbance.500_plus	patch.disturbance.500_plus.area patch.disturbance.500_plus.attractor patch.disturbance.500_plus.freqpercent patch.disturbance.500_plus.frequency patch.disturbance.500_plus.shape patch.disturbance.500_plus.size

The information regarding recent disturbances was output from the Patchworks model to be used to map recent disturbance by size class for the final DFMP of the West Side. The following information was output from the Patchworks model:

- Polygons with disturbance patch size attribute value > 0 (patch.disturbance.size > 0) were output for Period 1 (10 year), Period 2 (20 year) and Period 5 (50 year).
- Each polygon was labelled with the CMPKEY (unique identifier of polygons in the composite forest) and the size of the disturbance patch they were a member of and this information was used to numerically classify the disturbance for each planning period represented when joined to the original composite landbase file.
- A histogram of the percent area distribution for the size classes was created for each of the planning periods as well as the area (ha) within each size class.

3.4.6 Cover Group by Seral Stage landscape distribution and patch sizes

Broad cover group attributes and strata information were used to replicate the following cover class definitions in the Woodstock model. The seral stage definitions from the Woodstock model were also used to create accounts in the Patchworks model. The seral stage and cover class status of each polygon in the gross landbase of the West Side was then available to export for future planning periods.

The following seral stage accounts were created in Patchworks from the Woodstock model. Note that the %m in the label indicates the attribute applies to both the managed and unmanaged (gross) landbase:

Table 3-3. Patchworks Seral Stage account definitions.

	Attribute/Account Label	Description
Seral Stage (maturity class group)	feature.Area.Seral.%m.B	Maturity class group of breakup
	feature.Area.Seral.%m.I	Maturity class group of immature
	feature.Area.Seral.%m.Mat	Maturity class group of mature
	feature.Area.Seral.%m.Se	Maturity class group of stem exclusion
	feature.Area.Seral.%m.Si	Maturity class group of stem initiation

The following cover classes were defined for reports from the Woodstock yield strata. Note that the %m in the label indicates the attribute applies to both the managed and unmanaged (gross) landbase:

Table 3-4. Patchworks Cover Class account definitions.

	Cover Group	Theme 1 Strata	Cover Class Label	Description
Cover Class	feature.Area.Cover.%m.C	3,4,5,6	C_Sw	Coniferous white spruce
	feature.Area.Cover.%m.C	7	C_Pj	Coniferous pine
	feature.Area.Cover.%m.C	12	C_Sb	Coniferous black spruce
	feature.Area.Cover.%m.C	8,10	C_Con	Other coniferous stands
	feature.Area.Cover.%m.D		D	Deciduous
	feature.Area.Cover.%m.Dc	2,3,4,5	DC_Sw	Deciduous white spruce Mixedwood
	feature.Area.Cover.%m.Dc	9	DC_Pj	Deciduous pine Mixedwood

A lookup table by CMPKEY (unique identifier of polygons in the composite forest) f the cover class definition and seral stage classification for each forested polygon in the dataset was created for Period 0 (Initial conditions Year 0), Period 1 (10 year), Period 2 (20 year) and Period 5 (50 year).

Patch size accounts for each of the cover group and seral stage combinations were created in the Patchworks model to be able to classify the patch size distribution of the resulting forested landbase. The definition of the broad cover group seral patch size accounts created numerous additional accounts (20 Cover Seral accounts x 7 patch size accounts x 6 patch sub-accounts) but easily facilitated the required mapping of the landscape patch distribution in future planning periods (Planning Standard Objective 1.1.1.2). The following patch accounts were created:

Table 3-5. Patchworks BCGRP-Seral account definitions.

	Attribute/Account Label	Patch Size Ranges for each BCGP-Seral account
Broad Cover Group Seral stage accounts (gross landbase)	feature.CoverSeral.D_SI.size	0 – 5 5 – 10 10 – 50 50 – 100 100 – 250 250 – 500 500+
	feature.CoverSeral.D_SE.size	
	feature.CoverSeral.D_I.size	
	feature.CoverSeral.D_MAT.size	
	feature.CoverSeral.D_B.size	
	feature.CoverSeral.DC_SI.size	
	feature.CoverSeral.DC_SE.size	
	feature.CoverSeral.DC_I.size	
	feature.CoverSeral.DC_MAT.size	
	feature.CoverSeral.DC_B.size	
	feature.CoverSeral.CD_SI.size	
	feature.CoverSeral.CD_SE.size	
	feature.CoverSeral.CD_I.size	
	feature.CoverSeral.CD_MAT.size	
	feature.CoverSeral.CD_B.size	
	feature.CoverSeral.C_SI.size	
	feature.CoverSeral.C_SE.size	
	feature.CoverSeral.C_I.size	
	feature.CoverSeral.C_MAT.size	
	feature.CoverSeral.C_B.size	

The broad cover group seral stage patch size accounts were used to create a lookup table by CMPKEY (unique identifier of polygons in the composite forest) for each forested polygon in the West Side for Period 0 (Initial landbase conditions Year 0), Period 1 (10 year), Period 2 (20 year) and Period 5 (50 year). This table defines each polygon's BCG-Seral stage classification and the size of the patch to which it is a member.

3.4.7 Interior Old Forest map definitions

The interior old forest classification was run on the landbase resulting from the West Side spatial harvest sequence to help satisfy the Planning Standard Objective 1.1.1.2b (Area of old interior forest for each cover class). The following information was used to define the parameters for the old interior forest post processing from the Patchworks model.

- Selection Criteria: Forested (THEME1 != '0') and Stand Age > 120
- Edge (Buffer) Criteria:
  - Adjacent to mature forest = 0m edge
  - Adjacent to forest >=40 and not mature = 30m edge
  - Adjacent to other features = 60m edge

- Attribute information associated with shapefiles:
    - AVERAGEOFFSET (AGE)
    - THEME1, THEME2, THEME3, THEME4, THEME5, THEME6
    - Cover Class classifications
    - State: Edge polygon or Interior polygon
- Time Periods
    - Period 0 (Initial Conditions before harvest)
    - Period 1 (Condition at the end of 10 year period)
    - Period 2 (Condition at the end of 20 year period)
    - Period 5 (Condition at the end of 50 year period)
- Format: shapefiles for each planning period

3.5 GIS Processing

Where processing of geodatabase feature classes, shapefiles or database files was required, the following software packages were utilized, as appropriate.

- ESRI ArcGIS 10.0
- Microsoft Office 2010

4 Model Formulation

4.1 Woodstock

The desired future forest is based on a wildfire dominated natural disturbance regime incorporating a coarse-filter approach to maintaining species diversity.

A wide variety of input parameters and management assumptions must be specified prior to projecting harvest schedules with Woodstock. These are specified in order to reflect both the biological processes of the forest, as well as the current realities of operational forest management practices. A detailed description of input parameters and management assumptions follows.

4.1.1 Mountain Pine Beetle

Alberta is in the midst of a mountain pine beetle (MPB) infestation which is spreading across the forested lands of western Alberta. DMI's forest health activities will adhere to the "Alberta Forest Health Strategy and Shared Roles and Responsibilities between SRD and the Forest Industry" (Dec. 2003). Mountain Pine Beetle was not specifically managed for in this timber supply analysis. However, pine stands were preferentially selected in preblocking activities and a first period surge cut to capture pine was implemented..

4.1.2 Input Shapefiles

As part of the net landbase determination process, shapefiles are created for each FMU consistent with the requirements for Woodstock. This involves classifying the landscape into themes (described below), converting the age of stands (years) into a model age (10-year periods), and assigning pre-block information. Refer to the net landbase determination documentation for more information, and Section 10 for detailed data dictionaries.

The input shapefiles have undergone some changes since their initial creation from the net landbase determination process. Changes for pre-blocks are discussed in Section 4.1.12.

4.1.3 Effective Date

May 1, 2009 was selected as the effective date (this is also referred to as 'time 0' elsewhere in this submission). May 1st is the beginning of the timber operating year. The effective date represents the point in time that best reflects the forest attributes at the start of the TSA model. Every reasonable effort was made to have all input data sets consistent with that date. Given that the effective date of the model occurs in the past, the data inputs have been prepared to account for this. All known activities from the 2009, 2010, and 2011 timber years that were identified before June 15, 2011 have been specially handled. All of these known activities have been 'prescheduled' in the formulation. That is to say, the model is forced to perform those known actions in the first period.

4.1.4 Planning Horizon and Period Length

The period length was set at 10 years. The planning horizon used in this analysis was 200 years (20 periods) as required by Section 5.8 of the Planning Standard.

4.1.5 Lifespan

The lifespan identifies the maximum age of a development type before it is assumed to die or it is replaced by another development type. All models used a lifespan of 250 years.

4.1.6 Landscape

The landscape section defines the variables (themes) that are used to classify the landbase. The themes are described below.

4.1.6.1 Theme 1

Theme 1 assigns each polygon to a yield curve (stratum).

Stratum	Description
0	No strata assigned
1	Aspen>>Shrub
2	Aspen>>WhiteSpruce
3	Aspen>>LateMixed>>WhiteSpruce
4	Aspen>>EarlyMixed>>WhiteSpruce
5	AspenMixed>>WhiteSpruce

Stratum	Description
6	WhiteSpruce>>WhiteSpruce
7	Pine
8	Pine-BlackSpruce-Deciduous
9	Deciduous-Pine-BlackSpruce
10	Pine-WhiteSpruce
11	BalsamPoplar>>Shrub
12	BlackSpruce-Pine/WhiteSpruce
13	BlackSpruce – non Merchantable

Aggregates:

HARVOP	All the strata eligible for harvest
SUCCESS	All operable strata belonging to successional yield curves
EMPIRICAL	All operable strata belonging to empirical yield curves

4.1.6.2 Theme 2

Theme 2 assigns each polygon to a landbase which is assigned primarily based on broad cover group and includes one or more of the following:

LDIN	Accessible timber in the deciduous landbase.
LDSEN	Accessible timber in the deciduous landbase on sensitive slopes.
LCIN	Accessible timber in the coniferous landbase.
LCSEN	Accessible timber in the coniferous landbase on sensitive slopes.
LE	EMEND research site
OTHER	Areas for which landbase cannot be assigned – area not considered for harvest.

Aggregates:

DEC	Deciduous landbase available for harvest (LDIN).
CON	Coniferous landbase available for harvest (LCIN, LCSEN).
GOOD	Landbase available for harvest (DEC, CON).

4.1.6.3 Theme 3

Theme 3 indicates the status of each polygon.

NAT	Natural stands.
MAN	Managed stands.
BURN	Burned stands (fires after the 80s).
RET	Retention Areas
OTHER	Other stands not in the net landbase.
LINEAR	Linear deletions.

Aggregates:

GOOD	Polygons eligible for harvest (NAT, MAN, BURN, RET).

4.1.6.4 Theme 4

Theme 4 indicates the FMU of each polygon. Aggregates are used to identify the previous FMUs that comprise the SYU.

P10	
P11	
P1N	
P1S	
P2	

Aggregates:

P13	P11, P1S, P2
P19S	P11, P1S, P2, P1N
P19N	P10
West	P19N, P19S

4.1.6.5 Theme 5

Theme 5 is an empty theme being used for sensitivity analyses and is not used or constrained in the model.

4.1.6.6 Theme 6

Theme 6 identifies the cost zone of each polygon. The theme is an aggregate of deciduous and coniferous haul cost zones.

4.1.6.7 Theme 7

Theme 7 indicates the PFRA watershed catchment number for each polygon. These values were used in the ECA/water yield analysis.

4.1.7 Areas

The area file for each model was built using the automated Spatial Woodstock function (Build Section – Areas Section). The default format was used with five decimal places.

4.1.8 Yields

The following yield components make up each yield file.

ZONERES	Time-dependent yield curve that identifies which development types are ineligible for harvest in which periods. Any mask with a ZONERES value of 0 is ineligible for harvest.
HWVOL	Hardwood volume without retention reduction.
SWVOL	Softwood volume without retention reduction.
HWTARG	Hardwood Target Volume: NOT IMPLEMENTED
SWTARG	Softwood Target Volume: NOT IMPLEMENTED
C	Boolean indicator to identify if the stand has a broad cover group of "C". If the value is 1, it is a coniferous stand.
CD	Boolean indicator to identify if the stand has a broad cover group of "CD". If the value is 1, it is a coniferous-leading mixedwood stand.
DC	Boolean indicator to identify if the stand has a broad cover group of "DC". If the value is 1, it is a deciduous-leading mixedwood stand.
D	Boolean indicator to identify if the stand has a broad cover group of "D". If the value is 1, it is a deciduous stand.
SI	Boolean indicator to identify if the stand has a maturity class group of "SI". If the value is 1, it is in the Stem Initiation group.
SE	Boolean indicator to identify if the stand has a maturity class group of "SE". If the value is 1, it is in the Stem Exclusion group.
I	Boolean indicator to identify if the stand has a maturity class group of "I". If the value is 1, it is in the Immature group.
MAT	Boolean indicator to identify if the stand has a maturity class group of "MAT". If the value is 1, it is in the Mature group.
B	Boolean indicator to identify if the stand has a maturity class group of "B". If the value is 1, it is in the Break-up group.
HWPS	Deciduous piece size (trees per m^3) for hardwood volume.
SWPS	Coniferous piece size (trees per m^3) for softwood volume.
USEDPS	Piece size used for determining operational piece size of the stand. If the development type is deciduous dominated, the USEDPS is the HWPS component. If the development type is conifer dominated, the USEDPS is the SWPS component.
SMALL	Percentage of small stems (trees with a piece size of 5 trees per m^3 or smaller) that make up the total volume and is used for determining the operational piece size. If the mask is deciduous dominated, the SMALL value is the HWSMALL component. If the mask is coniferous dominated, the SMALL value is the SWSMALL component.
HWSMALL	Percentage of deciduous small stems (trees with a piece size of 5 trees per m^3 or smaller) that make up the total hardwood volume.
SWSMALL	Percentage of coniferous small stems (trees with a piece size of 5 trees per m^3 or smaller) that make up the total softwood volume.

HWMED	Percentage of deciduous medium stems (trees with a piece size of 2.5-5 trees per m^3) that make up the total hardwood volume.
SWMED	Percentage of coniferous medium stems (trees with a piece size of 2.5-5 trees per m^3) that make up the total softwood volume.
HWLARGE	Percentage of deciduous large stems (trees with a piece size of 2.5 trees per m^3 or larger) that make up the total hardwood volume.
SWLARGE	Percentage of coniferous large stems (trees with a piece size of 2.5 trees per m^3 or larger) that make up the total softwood volume.
SWLOGCOS	The cost to harvest the softwood volume.
HWLOGCOS	The cost to harvest the hardwood volume.
SWCHIPCO	The cost to chip the softwood volume.
HWCHIPCO	The cost to chip the hardwood volume.
USCOST	The additional harvest cost to protect the understorey beyond traditional harvest costs.
CHaulCost	The cost to haul the softwood volume to the appropriate mill.
DHaulCost	The cost to haul the hardwood volume to the appropriate mill.
T2COST	The cost of the “PL” plant treatment.
T3COST	The cost of the “SPPL” site prep and plant treatment.
T4COST	The cost of the “PLTD” plant and tend treatment.
T5COST	The cost of the “SPPLTD” site prep, plant and tend treatment.
T6COST	The cost of the “SEED” seed treatment.
HWRET	Percentage of hardwood volume that may be removed by harvest. The remaining volume will contribute to retention.
SWRET	Percentage of softwood volume that may be removed by harvest. The remaining volume will contribute to retention.
HW_VOL	Hardwood volume with retention reduction (HWVOL * HWRET)
SW_VOL	Softwood volume with retention reduction (SWVOL * SWRET)
TOTVOL	Total volume available for harvest, after retention volume is removed (HW_VOL + SW_VOL).
YTOTVOL	Total volume available for harvest without retention reduction (HWVOL + SWVOL).
C_SI	Boolean indicator to identify if the stand has a broad cover group of “C” and maturity class group of “SI” (C * SI).
C_SE	Boolean indicator to identify if the stand has a broad cover group of “C” and maturity class group of “SE” (C * SE).
C_I	Boolean indicator to identify if the stand has a broad cover group of “C” and maturity class group of “I” (C * I).
C_MAT	Boolean indicator to identify if the stand has a broad cover group of “C” and maturity class group of “MAT” (C * MAT).
C_B	Boolean indicator to identify if the stand has a broad cover group of “C” and maturity class group of “B” (C * B).
CD_SI	Boolean indicator to identify if the stand has a broad cover group of “CD” and maturity class group of “SI” (CD * SI).
CD_SE	Boolean indicator to identify if the stand has a broad cover group of “CD” and maturity class group of “SE” (CD * SE).

CD_I	Boolean indicator to identify if the stand has a broad cover group of "CD" and maturity class group of "I" (CD * I).
CD_MAT	Boolean indicator to identify if the stand has a broad cover group of "CD" and maturity class group of "MAT" (CD * MAT).
CD_B	Boolean indicator to identify if the stand has a broad cover group of "CD" and maturity class group of "B" (CD * B).
DC_SI	Boolean indicator to identify if the stand has a broad cover group of "DC" and maturity class group of "SI" (DC * SI).
DC_SE	Boolean indicator to identify if the stand has a broad cover group of "DC" and maturity class group of "SE" (DC * SE).
DC_I	Boolean indicator to identify if the stand has a broad cover group of "DC" and maturity class group of "I" (DC * I).
DC_MAT	Boolean indicator to identify if the stand has a broad cover group of "DC" and maturity class group of "MAT" (DC * MAT).
DC_B	Boolean indicator to identify if the stand has a broad cover group of "DC" and maturity class group of "B" (DC * B).
D_SI	Boolean indicator to identify if the stand has a broad cover group of "D" and maturity class group of "SI" (D * SI).
D_SE	Boolean indicator to identify if the stand has a broad cover group of "D" and maturity class group of "SE" (D * SE).
D_I	Boolean indicator to identify if the stand has a broad cover group of "D" and maturity class group of "I" (D * I).
D_MAT	Boolean indicator to identify if the stand has a broad cover group of "D" and maturity class group of "MAT" (D * MAT).
D_B	Boolean indicator to identify if the stand has a broad cover group of "D" and maturity class group of "B" (D * B).
PRI_D	Total hardwood volume from "D" broad cover group stands, without retention reduction (HWVOL * D).
PRI_DC	Total hardwood volume from "DC" broad cover group stands, without retention reduction (HWVOL * DC).
D_PRI	Total hardwood volume from "D" or "DC" broad cover group stands, without retention reduction (PRI_D + PRI_DC).
PRI_C	Total softwood volume from "C" broad cover group stands, without retention reduction (SWVOL * C).
PRI_CD	Total softwood volume from "CD" broad cover group stands, without retention reduction (SWVOL * CD).
C_PRI	Total softwood volume from "C" or "CD" broad cover group stands, without retention reduction (PRI_C + PRI_CD).
ST_CSW	Total number of softwood stems from "C" broad cover group stands (SWPS * SWVOL * C)
ST_CDSW	Total number of softwood stems from "CD" broad cover group stands (SWPS * SWVOL * CD).
CSW_ST	Total number of softwood stems from "C" or "CD" broad cover group stands (ST_CSW + ST_CDSW).
ST_CHW	Total number of hardwood stems from "C" broad cover group stands

	(HWPS * HWVOL * C).
ST_CDHW	Total number of hardwood stems from “CD” broad cover group stands (HWPS * HWVOL * CD).
CHW_ST	Total number of hardwood stems from “C” or “CD” broad cover group stands (ST_CHW + ST_CDHW).
ST_DSW	Total number of softwood stems from “D” broad cover group stands (SWPS * SWVOL * D).
ST_DCSW	Total number of softwood stems from “DC” broad cover group stands (SWPS * SWVOL * DC).
DSW_ST	Total number of softwood stems from “D” or “DC” broad cover group stands (ST_DSW + ST_DCSW).
ST_DHW	Total number of hardwood stems from “D” broad cover group stands (HWPS * HWVOL * D).
ST_DCHW	Total number of hardwood stems from “DC” broad cover group stands (HWPS * HWVOL * DC).
DHW_ST	Total number of hardwood stems from “D” or “DC” broad cover group stands (ST_DHW + ST_DCHW).
SM_HW	Total hardwood volume coming from small stems, without retention reduction (HWVOL * HWSMALL).
SM_SW	Total softwood volume coming from small stems, without retention reduction (SWVOL * SWSMALL).
MD_HW	Total hardwood volume coming from medium stems, without retention reduction (HWVOL * HWMED).
MD_SW	Total softwood volume coming from medium stems, without retention reduction (SWVOL * SWMED).
LG_HW	Total hardwood volume coming from large stems, without retention reduction (HWVOL * HWLARGE).
LG_SW	Total softwood volume coming from large stems, without retention reduction (SWVOL * SWLARGE).
PH_D_SM	Total hardwood volume from small stems with a “D” broad cover group, without retention reduction (HWVOL * HWSMALL * D).
PH_DC_SM	Total hardwood volume from small stems with a “DC” broad cover group, without retention reduction (HWVOL * HWSMALL * DC).
DPH_SM	Total hardwood volume from small stems with a “D” or “DC” broad cover group, without retention reduction (PH_D_SM + PH_DC_SM).
PH_D_MD	Total hardwood volume from medium stems with a “D” broad cover group, without retention reduction (HWVOL * HWMED * D).
PH_DC_MD	Total hardwood volume from medium stems with a “DC” broad cover group, without retention reduction (HWVOL * HWMED * DC).
DPH_MD	Total hardwood volume from medium stems with a “D” or “DC” broad cover group, without retention reduction (PH_D_MD + PH_DC_MD).
PH_D_LG	Total hardwood volume from large stems with a “D” broad cover group, without retention reduction (HWVOL * HWLARGE * D).
PH_DC_LG	Total hardwood volume from large stems with a “DC” broad cover group, without retention reduction (HWVOL * HWLARGE * DC).

DPH_LG	Total hardwood volume from large stems with a “D” or “DC” broad cover group, without retention reduction (PH_D_LG + PH_DC_LG).
PS_C_SM	Total softwood volume from small stems with a “C” broad cover group, without retention reduction (SWVOL * SMSMALL * C).
PS_CD_SM	Total softwood volume from small stems with a “CD” broad cover group, without retention reduction (SWVOL * SWSMALL * CD).
CPS_SM	Total softwood volume from small stems with a “C” or “CD” broad cover group, without retention reduction (PS_C_SM + PS_CD_SM).
PS_C_MD	Total softwood volume from medium stems with a “C” broad cover group, without retention reduction (SWVOL * SWMED * C).
PS_CD_MD	Total softwood volume from medium stems with a “CD” broad cover group, without retention reduction (SWVOL * SWMED * CD).
CPS_MD	Total softwood volume from medium stems with a “C” or “CD” broad cover group, without retention reduction (PS_C_MD + PS_CD_MD).
PS_C_LG	Total softwood volume from large stems with a “C” broad cover group, without retention reduction (SWVOL * SWLARGE * C).
PS_CD_LG	Total softwood volume from large stems with a “CD” broad cover group, without retention reduction (SWVOL * SWLARGE * CD).
CPS_LG	Total softwood volume from large stems with a “C” or “CD” broad cover group, without retention reduction (PS_C_LG + PS_CD_LG).
AG_ECA	Aspen – Good TPR ECA %
AG_HYD	Aspen – Good TPR hydrologic yield increase %
AM_ECA	Aspen – Medium TPR ECA %
AM_HYD	Aspen – Medium TPR hydrologic yield increase %
AF_ECA	Aspen – Fair TPR ECA %
AF_HYD	Aspen – Fair TPR hydrologic yield increase %
SG_ECA	Spruce – Good TPR ECA %
SG_HYD	Spruce – Good TPR hydrologic yield increase %
SM_ECA	Spruce – Medium TPR ECA %
SM_HYD	Spruce – Medium TPR hydrologic yield increase %
SF_ECA	Spruce – Fair TPR ECA %
SF_HYD	Spruce – Fair TPR hydrologic yield increase %
PG_ECA	Pine – Good TPR ECA %
PG_HYD	Pine – Good TPR hydrologic yield increase %
PM_ECA	Pine – Medium TPR ECA %
PM_HYD	Pine – Medium TPR hydrologic yield increase %
PF_ECA	Pine – Fair TPR ECA %
PF_HYD	Pine – Fair TPR hydrologic yield increase %
ECAPer	ECA %
HydYldPer	Hydrologic yield increase %

4.1.9 Actions

The action section is where activities/treatments to the forest are declared. Fundamentally, there are 2 actions: core harvest and contingency harvest. The

actions are differentiated based on haul cost, piece size and minimum operable age. Individual polygons may switch between core and contingency area as stands age.

Death is a system provided action that occurs when a stand reaches the lifespan age.

Core_D	Core deciduous harvest (theme2 = DEC)
Core_C	Core coniferous harvest (theme2 = CON)
ContD1	Contingency deciduous harvest.
ContC1	Contingency coniferous harvest.
ContD2	Contingency deciduous harvest.
ContC2	Contingency coniferous harvest.

Aggregates:

ContD	Contingency deciduous harvest.
ContC	Contingency coniferous harvest.
Harvest	Core_D, Core_C, ContD, ContC

4.1.9.1 Operability Limits

There are four main criteria that define whether an action can be taken on a specific development type, as shown in Table 4-1.

Table 4-1 Operability Limits for Core Harvest Actions

Criteria	Deciduous Landbase	Coniferous Landbase	
		P19S	P19N
Max Haul Cost ($)	16	10	14
Piece Size (min % large and medium wood)	70	50	50
Minimum Harvest Age (yrs) by yield strata			
1	80	80	80
2	80	80	80
3	90	90	90
4	90	90	90
5	100	100	100
6	100	100	100
7	100	100	100
8	100	100	100
9	110	110	110
10	100	100	100

11	90	90	80

Table 4-2 Operability Limits for Contingency Harvest Actions

Criteria	Deciduous Landbase	Coniferous Landbase	
		P19S	P19N
Max Haul Cost ($)	none	none	none
Piece Size (min % large and medium wood)	0	0	0
Minimum Harvest Age (yrs) by yield strata			
1	70	70	70
2	70	70	70
3	80	80	80
4	80	80	80
5	90	90	90
6	80	80	80
7	100	100	100
8	100	100	100
9	100	100	100
10	100	100	100
11	80	80	80

4.1.10 Transitions

There are two distinct types of transitions that are applied to each model – after death or after harvest action.

4.1.10.1 Death transitions

Stands that do not undergo a harvest action are subject to a mortality function when their age reaches the lifespan, as defined in the lifespan section. Stands are assumed to return to their pre-death stratum and are assigned an age of 0 and a status of ‘natural’ (theme 3 = NAT).

4.1.10.2 Harvest transitions

Stands that are harvested are assumed, for modeling purposes, to regenerate to the pre-harvest stratum and are assigned an age of 0 and a status of ‘managed’ (theme 3 = MAN). Transitions applied to harvest actions are supported with the commitment to conduct the necessary silviculture treatments that ensure that harvested stands return to the pre-harvest strata. Strict transition to pre-harvest strata ensures Long Run Sustained Yield (LRYS) does not decline over the planning horizon.

4.1.11 Outputs

A wide variety of outputs were generated for use as constraints or for reporting purposes. The following is a general description of the key outputs used in the model formulation. Remaining outputs used for reporting purposes are described in the output section of the models.

Output	Description
HV_TOTV	Total harvested volume. This is the sum of the yTOTVOL yield on all harvested areas. It represents the total hardwood and softwood volume without retention volume removed. It forms the objective function in P10 and P13.
PDHV_HWV	Primary hardwood volume harvested by the Core_D action. It is constrained to be evenflow across the planning horizon.
PFHV_HWV	Primary hardwood volume harvested by the Cont_D action. It is constrained to be evenflow across the planning horizon.
PQHV_SSWV	Primary softwood volume harvested by the Core_C action in P17S. It is constrained to be evenflow across the planning horizon.
PQHV_NSWV	Primary softwood volume harvested by the Core_C action in P17N. It is constrained to be evenflow across the planning horizon.
PFHV_SSWV	Primary softwood volume harvested by the Cont_C action in P17S. It is constrained to be evenflow across the planning horizon.
PFHV_NSWV	Primary softwood volume harvested by the Cont_C action in P17N. It is constrained to be evenflow across the planning horizon.
IDHV_HWV	Incidental hardwood volume harvested by the Core_C or Cont_C actions, in the Core D cost zone. It is constrained to be evenflow across the planning horizon.
IFHV_HWV	Incidental hardwood volume harvested by the Core_C or Cont_C actions, in the Cont D cost zone. It is constrained to be evenflow across the planning horizon.
IQHV_SSWV	Incidental softwood volume harvested by the Core_D or Cont_D actions, in the Core C cost zone in P17S. It is constrained to be evenflow across the planning horizon.
IQHV_NSWV	Incidental softwood volume harvested by the Core_D or Cont_D actions, in the Core C cost zone in P17N. It is constrained to be evenflow across the planning horizon.
IFHV_SSWV	Incidental softwood volume harvested by the Core_D or Cont_D actions, in the Cont C cost zone in P17S. It is constrained to be evenflow across the planning horizon.
IFHV_NSWVV	Incidental softwood volume harvested by the Core_D or Cont_D actions, in the Cont C cost zone in P17N. It is constrained to be evenflow across the planning horizon.
OP_HWV	Operable hardwood growing stock. This is constrained to be non-declining over the last quarter of the planning horizon across the west side.
OP_SWV	Operable softwood growing stock. This is constrained to be non-

Output	Description
	declining over the last quarter of the planning horizon in each of P17N and P17S.
CON_M_AR	Conifer cover group (C/CD) area in the mature seral stage. This is the sum of the C_MAT and CD_MAT yields on the successional landbase. It is used in the seral stage targets.
CON_B_AR	Conifer cover group (C/CD) area in the break-up seral stage. This is the sum of the C_B and CD_B yields on the successional landbase. It is used in the seral stage targets.
DEC_M_AR	Deciduous cover group (D/DC) area in the mature seral stage. This is the sum of the D_MAT and DC_MAT yields on the successional landbase. It is used in the seral stage targets.
DEC_B_AR	Deciduous cover group (D/DC) area in the break-up seral stage. This is the sum of the D_B and DC_B yields on the successional landbase. It is used in the seral stage targets.
EMPOLD	Area of empirical harvestable landbase in the 'old' seral stage (age >= 100 years). It is used in the seral stage targets for P10 and P13.

4.1.12 LP Schedule

Planned operational blocks (pre-blocks) are included in the model using the LP schedule in Woodstock. The LP schedule lists the area of development type classes to treat with specific actions in specific planning periods. To create the LP schedule file with Woodstock, the shapefile must include attributes identifying the pre-blocks.

The LP schedule was generated using the automated Spatial Woodstock function (Build section – Schedule section).

4.1.13 Optimize

The optimize section is where the objective function and constraints are formulated as a linear program.

4.1.13.1 Objective Function

P19 utilizes a 'dissolved' landbase therefore the objective function was set to maximize total harvested volume (HV_TOTV), regardless of landbase. An additional factor was subtracted from the total harvest volume that limits the 1-period primary conifer surge cut in P19S.

4.1.13.2 Constraints

Constraints are rule sets representing management objectives that are applied to outputs. The constraints applied are as follows:

4.1.13.2.1 Harvest Flows

Constraints have been incorporated into the model to ensure that the harvest levels are sustainable over time. Harvest flow constraints also add operational feasibility by ensuring that an equal amount of volume is harvested each period.

Primary deciduous harvest was constrained to be evenflow for each of the core (PDHV_HWV) and contingency (PFHV_HWV) areas for the entire planning horizon across the entire west side. Primary coniferous harvest was similarly constrained to be evenflow for each of the core (PQHV_*) and contingency (PFHV_*) areas for the entire planning horizon, but split also by north (*_NSWV) and south (*_SSWV) portions of the west side to coincide with quota allocations.

The exception to the above is for primary core softwood volume in P19S, which was constrained to be evenflow from period 2 onwards, thus allowing a surge cut in period1.

Incidental harvest flows were constrained similarly to primary harvest flows, but only for the first 20 years. There was no surge cut in incidental volumes permitted.

4.1.13.2.2 Growing Stock

As a measure of long term sustainability, and to mitigate the ‘horizon effect’ common in timber supply analyses, the amount of operable growing stock was not permitted to decline over the last quarter of the planning horizon, consistent with Section 5.8 of the Planning Standard. Operable growing stock is determined through a system function in Woodstock that sums the volume available for harvest in the absence of any constraints.

Operable hardwood growing stock (OP_HWV) is constrained for the entire west side. Operable softwood growing stock (OP_SWV) is constrained independently for the north and south portions.

4.1.13.2.3 Seral Stage

The intent of seral stage constraints is to ensure the future forest is not radically different than the current natural forest. In doing so, it is anticipated the ecosystem function of the forest will be maintained, while still supplying the mill with a sustainable, affordable, quality fibre supply. Section 7 details the methodology used to derive seral stage targets. Table 4-3 summarizes the

results (from 'targets2011.xls'). These targets represent the 200-year target for the desired future forest. Short-term targets (10 years) are defined by the seral stage / cover type indicators resulting from the SHS.

Table 4-3 Seral Stage Target Area (ha)

Strata	FMU P19
Mature Conifer	17,692
'Breakup' Conifer	28,116
Mature Deciduous	28,522
'Breakup' Deciduous	40,120
'Old' Empirical Strata	53,910

The seral stage targets had to be met or exceeded by the end of the planning horizon (period 20). Interim targets were also set, such that from period 5 onwards, 50% of the breakup seral stage target had to be met. In addition, the area within each mature successional seral stage could not decline from period 12 onwards. These interim targets were required because the starting forest structure could not achieve the theoretical targets. The break point ages and magnitudes are based on the no-harvest scenario forecasts of minimum possible levels.

4.1.13.2.4 Water Yield

Forecasting of the impact of timber harvesting on water yield is required under the Planning Standard (Annex 1, Section 5.9.13 and Annex 4, Objective 3.2.1.1). This was accomplished through the use of the ECA-Alberta model to generate decadal hydrologic yield increase curves. This permitted Woodstock to dynamically calculate the increase in water yield for each watershed catchment area, which was then constrained to a maximum of 15% yield increase per catchment.

For additional information on how the hydrologic water yield increase curves were generated, see Appendix 5.

4.2 Stanley

Stanley assigns actions to polygons, subject to spatial rule sets, in an attempt to match the optimal aspatial output values from Woodstock. The resulting spatial harvest sequence (SHS) is a key output of the TSA process as it incorporates the strategic objectives necessary to achieve the desired future forest into operational planning. Therefore, adherence to the SHS is desireable. DMI commits to following the mapped 10-year SHS as presented in this document, or

as formally revised. Variance from the SHS will be tracked and reported as per Annex 1, Section 6.6 of the Planning Standard.

The Stanley parameters are outlined in Table 4-4 and described in more detail throughout this section.

Table 4-4 Summary of Stanley Parameters

Parameter	FMU P19
Spatial planning horizon (periods)	1-8
Maximum deviations (pd)	1
Objectives	PDHV_HWV PFHV_HWV PQHV_NSWV PQHV_SSWV PFHV_NSWV PFHV_SSWV
Adjacency distance (m)	100
Minimum block size (ha)	5
Target block size (ha)	150
Proximal distance (m)	25
Green-up delay (pd)	0
Maximum opening size	1000
Multi-period openings	Yes

4.2.1 Periods to Block (Spatial Planning Horizon)

Stanley was used to block harvest activities (i.e., spatially allocate actions to polygons) for the first 70 years (7 periods) from the effective date. Consistent with the allowable timing deviations, Stanley was set to block the first 8 periods, though period 8 was not assigned any weighting (see Section 4.2.3). In essence, period 8 was considered by Stanley only in terms of improving the solution in the first 70 years. The 'preserve.prg' script, which was run after the Stanley solution was resolved, removed any blocks that may have been scheduled in period 8.

4.2.2 Maximum Deviations

Stanley attempts to follow the Woodstock schedule when assigning actions to development types. However, Stanley parameters may prevent it from following the schedule precisely. In this case Stanley may advance or delay the period in which the action is assigned to a development type up to the specified maximum number of deviations.

The model used a 1 period maximum deviation from the Woodstock scheduled period. If Stanley must deviate from the optimal timing by more than specified deviations, the output from the block does not contribute to the objective function.

4.2.3 Objectives

Stanley uses Woodstock outputs as the objective for blocking. Stanley assigns actions to polygons in the timing and amount specified in the Woodstock schedule, within the allowable deviations and parameters, to closely match the Woodstock outputs.

Stanley used six objectives derived from Woodstock outputs:

- harvested core primary hardwood volume (PDHV_HWV),
- harvested contingency primary hardwood volume (PFHV_HWV),
- harvested core primary softwood volume from P19 north (PQHV_NSWV),
- harvested core primary softwood volume from P19 south (PQHV_SSWV),
- harvested contingency primary softwood volume from P19 north (PFHV_NSWV),
- harvested contingency primary softwood volume from P19 south (PQHV_SSWV).

Stanley objectives can be weighted to establish their relative importance. All objectives were given equal weighting of 1. Periodic weights can also be used to prioritize a single objective in specific planning periods. All periods were given an equal weighting of 1 across all objectives.

Period 8, considered by Stanley only for allowable deviations to improve the allocations in the first 7 periods, received a weighting of -1 (essentially turned off).

The desired flow tolerance parameter determines the acceptable variation in the flow of outputs produced from the actions assigned to polygons. Spatial flow tolerances are generally greater than aspatial flow tolerances. As strict evenflow (i.e., 0% variation) was used in the aspatial model, a 10% flow tolerance was used for harvest volume objectives in Stanley, consistent with the allowable tolerance specified in Section 5.8 of the Alberta Forest Management Planning Standard.

4.2.4 Adjacency Distance

Adjacency distance is a ‘block parameter’ that affects the size and shape of Stanley blocks. Polygons that are within the adjacent distance of one another may be grouped together as a single harvest block by Stanley, subject to opening size constraints. All models used an adjacent distance of 100 meters.

4.2.5 Minimum Block Size

The minimum block size represents the smallest, operationally-feasible block that Stanley can make. If a grouping of adjacent polygons cannot exceed the minimum block size, the polygons will be identified as impossible to block and become isolated stands. The minimum block size was constrained to 5 ha.

4.2.6 Target Block Size

The target block size parameter establishes the optimal block size. Stanley will attempt to aggregate adjacent polygons until the block reaches the target block size, subject to the remaining constraints. The target block size was set to 150 ha.

4.2.7 Proximal Distance

Proximal distance is an 'opening parameter'. An opening is defined as a group of harvest blocks within the proximal distance of one another that are in green-up. The proximal distance represents how close harvest blocks can be to one another or, conversely, how far away two openings must be from each other to be scheduled in the same period. Once Stanley assigns a block to a harvest period, proximal stands cannot be scheduled until the harvest block has achieved green-up. The proximal distance parameter was set to 25 meters for all models.

4.2.8 Green-Up Delay

Green-up delay is defined as the length of time it takes for a harvest block to green-up, thus allowing the scheduling of proximal harvest blocks. A 0-period green-up delay was used (equivalent to 0-5 years). Green-up delay does not play a significant role when allowing multi-period openings with no maximum opening size.

4.2.9 Maximum Opening Size

An opening is defined as a group of harvest blocks within the proximal distance of one another that are in green-up. The maximum opening size parameter defines the upper limit on the size of openings. There was no maximum opening size parameter used in any model.

4.2.10 Multi-Period Openings

The multi-period openings parameter determines whether or not Stanley can create openings that span more than one planning period. Blocks within an

opening will be scheduled in the same planning period unless multi-period openings are allowed. Multi-period openings were permitted in all models.

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5 Preferred Forest Management Scenario Decision Making Process

5.1 Scenario Planning

A variety of alternative models were formulated before deriving the preferred scenario. Each model utilized the same landbase and yield projections but differed in the constraint formulation and objective function.

The aspatial model runs tested included the following:

- Divided Landbase, 2 VSA
- Divided Landbase 1SYU
- Amalgamated Landbase 1 SYU
  - With Landscape Targets
  - Without Landscape Targets
  - Tested intensive/extensive management zones
  - Control total volume vs control pure/incidental
  - Systematic testing of cost and quality combinations.
- Various operability limits and piece size constraints
- Dissolved Landbase, no incidental
  - 2 VSA
  - 1 SYU
- Amalgamated FMU with 1 deciduous SYU and 2 Conifer VSA
  - With preschedule
  - Without preschedule
- Mock-up of 2007 preferred strategy
- Many runs with varying core / contingency definitions

The primary purpose of the test runs were to calibrate the new inventory and yield curves with the new DFA. It was determined that the desirable mix of timber and non-timber indicator results came from a version of the 2007 preferred scenario.

The 2007 scenario was set as the target with the intent of incorporating the core/contingency concept and incorporating a 10 year pre-selection of blocks. The 10 year pre-sequence was chosen to balance tactical needs like cost, roading, summer vs winter ground, and pine beetle concerns.

The conifer pre-sequence in VSA2 (south) was selected with a strong bias for pine. It is a surge cut that hopes to capture endangered pine before it dies and is unusable.

The preferred strategy incorporates volume flow controls that allowed the companies to directly compare their previous rights and tenures to the newly adopted amalgamation scenario rights.

The final selected strategy achieves the non-timber targets while meeting the newly defined economic targets and it incorporates the new inventory and management concepts. The final selected sequence represents a long iterative decision making process.

5.2 Public Involvement

All tested scenarios were presented to the PAC.

Several specific meetings were held to discuss planned strategies. The idea of implementing an intensive/extensive zone strategy was discarded following the PAC process at the request of the PAC. Considerable time was spent discussing the Core/contingency and amalgamation of FMUs.

5.3 Stakeholder Involvement

The companies affected by this plan were highly engaged throughout the development of it. Companies met through PDT meetings and one-on-one business meetings to work out the details of the plan selection and allocation decisions. Industry met alone on many occasions when only business decisions were required. The entire PDT, including SRD representatives, was called to meet when government policy decisions were required.

The industry stakeholders wanted this plan to be as close to the 2007 approved DFMP in terms of management selections, VOITs, etc. The overriding concerns governing industry decisions were:

- Maintain 2007 approved DFMP VOITs and general management approach
- Support amalgamated FMU
- Implement core/contingency
- Implement a manually selected period 1 harvest sequence to minimize variance in coming years

- Address the pine beetle problem.
- Control volume flows so that the 'old' quotas could be transparently transformed into the 'new' quotas in the new amalgamated FMU.
- Simplify quotas
- Provide required input to finalize formal Volume Supply Agreements that enable creation of volume supply areas within the new amalgamated FMU.

5.4 Selection of Spatial Harvest Sequence

The total strategy including the spatial pre-schedule was run through the Woodstock model several times to ensure sustainability of all indicators. The pre-schedule was adjusted in response on two separate iterations.

Upon finding an aspatial run that met all parameters, a spatial run was completed in Stanley and spatial outputs were produced. The spatial indicators were examined and found to be acceptable. The final model run was selected on Nov 24, 2011 and is presented through this submission as the Preferred Forest Harvest Schedule (PFHS).

5.5 Allocation

The allocation of the PFHS volumes was completed through several workshop-style meetings. Each company identified their existing active licenses and recent past cutovers. Company names were iteratively applied to the first period blocks and volume checks were tabulated. Companies co-operatively selected blocks in line with the Volume Supply Agreements.

The detailed description of the allocation procedure is found in the *Targets & Implementation* document.

6 Preferred Forest Management Scenario

6.1 Model Formulation

A very detailed iterative scenario planning process was investigated in the development of the 2007 DFMP for FMA8900027. Upon approval of that plan in 2008, the industry stakeholders decided to carry forward the preferred management strategy on the new forest inventory data and new yield curves. The TOR for this DFMP reflects that decision. Consequently, the modeling during this planning exercise focussed on fine-tuning a predetermined strategy rather than exploring all options and picking the most desirable one.

The modeling exercise focused on implementing the core-contingency model. It also focussed on pre-selecting 10 years of harvest stands. The conifer operators added to their selections by targeting pine content in a surge cut.

The PFMS builds on the aspatial Woodstock models by incorporating the spatial harvest sequence (SHS) from Stanley. Details on how the PFMS was derived can be found in section 4.1.12 - LP Schedule

The 70-year (7-period) spatial harvest sequence (SHS) generated from Stanley, which incorporates planned preblocks, was used to generate a revised LP schedule. The LP schedule lists the area of development types to treat with specific actions in specific planning periods. In essence, the SHS is treated as pre-blocks. To ensure Woodstock does not plan additional harvest areas during the spatial planning horizon, only harvest actions defined in the LP schedule (covering the 7-period spatial planning horizon) are permitted. From period 8 onwards, Woodstock generates a new aspatial sequence of actions that take the SHS into consideration.

6.1.1 Optimize

The optimize section is where the objective function and constraints are formulated as a linear program. Generally, the optimize section closely follows the aspatial formulations. Minor differences were required to account for the spatial harvest sequence, as explained below.

6.1.1.1 Objective Function

The objective function in all models was unchanged - the maximization of harvested volume over the planning horizon, consistent with the aspatial model (see Section 4.1.13.1).

6.1.1.2 Constraints

6.1.1.2.1 Harvest Flows

Harvest flow constraints were modified consistent with Section 5.8 of the Alberta Forest Management Planning Standard (Version 4.1) to allow the periodic harvest to vary by ± 5% of the period 7 volume.

6.1.1.2.2 Growing Stock

The constraints imposed on the operable growing stock remained unchanged from the aspatial models. Refer to Section 4.1.13.2.2 for further information.

6.1.1.2.3 Seral Stage

The seral stage constraints remained unchanged from the aspatial models, with one exception. Constraints that were applied from period 5 onwards were changed to be from period 8 onwards, to incorporate the 7-period SHS. The main constraints of meeting seral stage targets by the end of the planning horizon were met.

6.2 Forecasted Harvest Levels (AAC)

The sustainable harvest levels forecast are outlined in Table 6-1. These values do not incorporate any structure retention or planning losses. These AAC numbers are presented here for approval of the calculation steps. This section provides AAC numbers based on the 200 year averages in order to provide a consistent comparison/contrast with previous TSA results.

These forecast 200 year numbers are used in further calculations to arrive at the proposed AAC. Specifically, the 200 year averages were used to determine AAC % split allocations between companies. The % splits were then applied to the spatial sequence to arrive at the proposed AAC. The details about allocation of these results are presented in the *Targets & Implementation* document.

Table 6-1. Forecast Annual Allowable Cuts from Spatial Playback (Nov 24, 2011 Final Run)

Draft PFMS, spatial playback (05_pfms_spb)	November-24-11																				200 year Average	Period 2 - 20 190 year average	Period 2 - 7 60 year average
NAME	PERIOD1	PERIOD2	PERIOD3	PERIOD4	PERIOD5	PERIOD6	PERIOD7	PERIOD8	PERIOD9	PERIOD10	PERIOD11	PERIOD12	PERIOD13	PERIOD14	PERIOD15	PERIOD16	PERIOD17	PERIOD18	PERIOD19	PERIOD20			
Cont, incidental decid, all	26,356	23,370	21,501	18,668	23,017	29,024	11,421	23,451	1,467	12,440	19,207	21,572	27,619	13,657	18,190	33,148	14,409	21,791	11,643	31,859	20,190	19,866	21,167
Cont, primary decid, all	78,288	78,295	78,296	78,325	78,291	78,298	78,296	76,825	76,825	76,825	80,869	80,869	80,869	76,825	76,825	76,825	80,869	80,869	80,869	80,869	78,756	78,781	78,300
Cont, total decid, all	104,645	101,665	99,796	96,993	101,308	107,321	89,718	100,276	78,292	89,265	100,075	102,441	108,487	90,482	95,015	109,973	95,278	102,660	92,511	112,727	98,946	98,646	99,467
Core, incidental decid, all	165,161	142,126	149,334	77,551	32,979	24,905	67,489	64,192	105,519	67,559	142,109	192,523	334,448	105,366	38,635	53,217	68,380	98,661	132,967	361,719	121,242	118,930	82,397
Core, primary decid, all	423,555	423,551	423,550	423,553	423,556	423,569	423,540	402,363	402,363	402,363	402,363	423,540	423,540	402,363	402,363	402,363	422,884	423,540	423,540	423,540	416,100	415,708	423,553
Core, total decid, all	588,716	565,677	572,884	501,104	456,535	448,475	491,029	466,555	507,882	469,922	544,472	616,063	757,988	507,729	440,999	455,580	491,264	522,201	556,507	785,259	537,342	534,638	505,951
Cont, incidental conifer, north	573	3,771	11,709	27,454	19,951	31,648	6,445	10,010	471	11,129	4,562	6,552	5,011	9,988	10,232	13,594	4,332	3,388	2,439	4,706	9,398	9,863	16,829
Cont, primary conifer, north	22,662	22,964	23,304	25,174	25,181	25,175	24,724	26,026	26,026	26,026	26,026	26,026	24,724	24,724	24,724	24,724	24,724	24,724	26,026	26,026	24,985	25,108	24,420
Cont, total conif, north	23,234	26,734	35,013	52,628	45,132	56,822	31,169	36,036	26,496	37,155	30,588	32,578	29,736	34,712	34,956	38,318	29,056	28,112	28,464	30,732	34,384	34,970	41,250
Core, incidental conif, north	36,408	58,249	60,266	74,348	57,484	34,265	26,092	37,138	21,684	22,274	37,245	24,769	27,075	26,855	23,857	25,698	23,629	33,004	20,286	24,319	34,747	34,660	51,784
Core, primary conifer, north	57,816	57,835	57,798	57,807	57,810	57,814	57,759	57,759	57,759	57,759	57,759	57,759	54,871	54,871	54,871	54,871	54,871	54,871	54,871	57,759	56,764	56,709	57,804
Core, total conif, north	94,223	116,084	118,065	132,155	115,294	92,079	83,850	94,896	79,443	80,033	95,004	82,528	81,946	81,725	78,728	80,568	78,500	87,875	75,156	82,078	91,511	91,369	109,588
Cont, incidental conifer, south	18,592	43,384	47,035	40,349	22,483	18,398	20,892	20,846	2,531	14,782	20,778	18,082	13,755	16,125	16,542	5,468	10,239	8,738	5,582	21,145	19,287	19,324	32,090
Cont, primary conifer, south	123,951	133,284	124,546	126,873	130,302	132,046	138,878	146,188	146,188	146,188	146,188	146,188	138,878	138,878	138,878	138,878	138,878	138,878	146,188	146,188	138,323	139,080	130,988
Cont, total conif, south	142,542	176,669	171,580	167,222	152,785	150,444	159,771	167,034	148,719	160,970	166,966	164,270	152,634	155,003	155,421	144,346	149,118	147,616	151,770	167,333	157,611	158,404	163,078
Core, incidental conif, south	116,849	197,097	155,672	99,170	146,255	139,732	112,770	181,333	68,544	54,896	127,220	80,466	89,250	40,809	41,587	73,298	102,617	85,055	57,087	93,646	103,168	102,448	141,783
Core, primary conifer, south	374,987	192,853	192,854	192,816	192,871	192,829	192,853	197,009	197,009	197,009	197,009	197,009	187,158	187,158	187,158	187,158	187,158	187,158	197,009	197,009	201,704	192,583	192,846
Core, total conifer, south	491,835	389,949	348,525	291,986	339,126	332,561	305,623	378,342	265,553	251,905	324,229	277,475	276,408	227,967	228,745	260,456	289,775	272,213	254,096	290,654	304,871	295,031	334,628
VSA1 Conifer Total	117,457	142,818	153,077	184,783	160,426	148,901	115,019	130,932	105,939	117,188	125,592	115,106	111,681	116,437	113,684	118,886	107,556	115,987	103,620	112,810	125,895	126,339	150,837
VSA2 Conifer Total	634,378	566,618	520,106	459,208	491,911	483,005	465,393	545,376	414,272	412,875	491,195	441,744	429,042	382,971	384,165	404,802	438,892	419,829	405,866	457,987	462,482	453,435	497,707
P19 Conifer Total	751,835	709,436	673,183	643,990	652,336	631,906	580,412	676,308	520,211	530,063	616,786	556,850	540,723	499,408	497,849	523,689	546,448	535,816	509,486	570,797	588,377	579,774	648,544
Total hardwood harvest	693,360	667,342	672,680	598,096	557,843	555,796	580,747	566,831	586,173	559,187	644,547	718,504	866,476	598,212	536,013	565,553	586,542	624,861	649,018	897,986	636,288	633,285	605,417
Total softwood harvest	751,835	709,436	673,183	643,990	652,336	631,906	580,412	676,308	520,211	530,063	616,786	556,850	540,723	499,408	497,849	523,689	546,448	535,816	509,486	570,797	588,377	579,774	648,544
Total harvest volume	1,445,195	1,376,778	1,345,863	1,242,087	1,210,179	1,187,702	1,161,159	1,243,138	1,106,384	1,089,250	1,261,333	1,275,354	1,407,198	1,097,619	1,033,863	1,089,241	1,132,990	1,160,677	1,158,504	1,468,783	1,224,665	1,213,058	1,253,961
Total Primary Hardwood Harvest	501,843	501,847	501,846	501,878	501,847	501,867	501,836	479,188	479,188	479,188	483,232	504,409	504,409	479,188	479,188	479,188	503,753	504,409	504,409	504,409	494,856	494,488	501,853
Total Primary Softwood Harvest	579,414	406,936	398,501	402,669	406,164	407,864	414,214	426,981	426,981	426,981	426,981	426,981	405,632	405,632	405,632	405,632	405,632	405,632	424,093	426,981	421,776	413,480	406,058
Total Primary Harvest Volume	1,081,257	908,782	900,346	904,547	908,011	909,731	916,050	906,169	906,169	906,169	910,212	931,389	910,040	884,820	884,820	884,820	909,384	910,040	928,501	931,389	916,632	907,968	907,911
Total Secondary Hardwood Harvest	191,517	165,496	170,834	96,219	55,996	53,929	78,910	87,643	106,985	79,999	161,316	214,095	362,067	119,023	56,825	86,365	82,790	120,452	144,610	393,578	141,432	138,796	103,564
Total Secondary Softwood Harvest	172,420	302,500	274,682	241,321	246,173	224,042	166,199	249,327	93,230	103,082	189,805	129,870	135,091	93,776	92,218	118,057	140,816	130,185	85,394	143,817	166,600	166,294	242,486
Total Secondary Harvest Volume	363,938	467,996	445,516	337,540	302,169	277,971	245,109	336,970	200,215	183,081	351,121	343,965	497,158	212,800	149,043	204,422	223,606	250,637	230,033	537,394	308,033	305,090	346,050
Primary D volume, core D stand, core C cost zone	419,769	369,513	332,231	336,653	372,128	378,973	372,829	379,664	400,054	346,176	344,228	330,905	369,968	331,301	328,094	361,885	404,619	366,656	378,404	332,934	362,849	359,853	360,388
Primary C volume, core C (north) stand, core D cost zone	52,978	56,568	52,610	55,260	34,906	20,880	47,874	43,131	55,914	52,162	26,340	50,966	49,707	54,378	35,603	20,196	37,746	44,550	51,252	53,331	44,818	44,388	44,683
Primary C volume, core C (south) stand, core D cost zone	374,987	188,916	192,854	192,816	192,871	192,829	192,853	197,009	197,009	197,009	197,009	197,009	187,158	187,158	187,158	187,158	187,158	187,158	197,009	197,009	201,507	192,376	192,190
Primary D volume, cont D stands, core C cost zone	26,153	31,448	44,538	27,666	37,441	16,384	35,611	20,907	38,927	39,147	39,146	44,590	64,744	19,732	26,689	46,749	50,665	59,159	43,651	66,965	39,016	39,693	32,181
Primary C volume, core C (north) stand, cont D cost zone	4,837	1,267	5,188	2,547	22,903	36,934	9,885	14,627	1,845	5,597	31,419	6,792	5,164	493	19,268	34,675	17,125	10,321	3,619	4,427	11,947	12,321	13,121
Primary C volume, core C (south) stand, cont D cost zone	0	3,937	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	197	207	656
Incidental C volume, core D stand, core C (north) cost zone	32,535	53,750	53,835	67,330	45,612	28,398	18,390	33,715	18,584	14,026	31,722	22,437	25,427	24,976	19,433	22,951	17,559	29,712	18,028	18,283	29,835	29,693	44,552
Incidental C volume, core D stand, core C (south) cost zone	106,753	194,165	145,944	99,170	145,290	139,604	96,911	173,488	67,848	51,575	110,089	63,828	68,143	39,017	36,638	48,428	88,808	78,150	56,590	37,195	92,382	91,625	136,847
Incidental D volume, Core C stand, core D cost zone	122,625	80,054	108,295	51,871	23,195	17,344	18,895	34,265	71,830	34,165	51,512	84,763	245,519	85,159	26,762	26,086	27,876	61,599	73,812	101,615	67,362	64,453	49,942
Incidental C volume, cont D stand, core C (north) cost zone	3,872	4,499	6,431	7,018	11,872	5,867	7,702	3,423	3,100	8,248	5,523	2,332	1,648	1,879	4,424	2,747	6,070	3,292	2,257	6,037	4,912	4,967	7,232
Incidental C volume, cont D stand, core C (south) cost zone	10,096	2,931	9,728	0	965	128	15,860	7,845	697	3,321	17,131	16,638	21,107	1,792	4,949	24,870	13,809	6,905	498	56,450	10,786	10,822	4,935
Incidental D volume, Core C stand, cont D cost zone	2,147	1,638	2,067	643	6,487	8,286	1,904	3,324	28	806	1,464	3,187	5,956	152	3,491	9,312	4,106	2,680	1,845	2,936	3,123	3,174	3,504
Primary D volume, core D stand, cont C cost zone	3,785	54,038	91,319	86,900	51,428	44,596	50,712	22,700	2,309	56,187	58,135	92,636	53,572	71,062	74,270	40,478	18,265	56,884	45,136	90,607	53,251	55,854	63,165
Primary C volume, cont C (north) stand, core D cost zone	19,832	19,494	14,832	2,780	4,889	8,053	4,045	2,453	4,901	17,080	24,589	20,179	19,466	3,911	4,674	7,959	6,926	4,205	20,243	24,026	11,727	11,300	9,015
Primary C volume, cont C (south) stand, core D cost zone	53,333	83,651	96,460	91,092	72,092	32,513	96,056	117,471	146,065	83,210	108,212	127,649	122,816	92,995	89,997	53,997	105,460	110,190	133,079	133,547	97,494	99,818	78,644
Primary D volume, cont D stands, cont C cost zone	52,135	46,847	33,758	50,659	40,850	61,913	42,685	55,918	37,898	37,678	41,723	36,279	16,124	57,093	50,136	30,077	30,203	21,710	37,217	13,904	39,740	39,088	46,119
Primary C volume, cont C (north) stand, cont D cost zone	2,829	3,469	8,472	22,394	20,292	17,122	20,680	23,573	21,124	8,946	1,437	5,846	5,259	20,814	20,050	16,765	17,799	20,519	5,782	2,000	13,259	13,807	15,405
Primary C volume, cont C (south) stand, cont D cost zone	70,618	49,634	28,085	35,781	58,210	99,533	42,823	28,717	123	62,978	37,976	18,539	16,063	45,884	48,881	84,881	33,419	28,688	13,109	12,641	40,829	39,261	52,344
Incidental C volume, core D stand, cont C (north) cost zone	74	3,038	7,729	13,941	7,910	8,827	373	7,374	37	158	1,909	4,510	3,929	6,703	1,435	6,047	181	2,018	656	3,618	4,023	4,231	6,970
Incidental C volume, core D stand, cont C (south) cost zone	2,007	33,588	45,047	38,721	19,817	12,701	11,548	10,271	549	11,669	15,168	16,311	12,090	11,516	11,444	2,819	8,517	8,738	5,017	11,029	14,428	15,082	26,904
Incidental D volume, Cont C stand, core D cost zone	42,537	62,072	41,038	25,680	9,784	7,562	48,594	29,926	33,689	33,394	90,597	107,760	88,929	20,208	11,874	27,132	40,505	37,062	59,155	260,104	53,880	54,477	32,455
Incidental C volume, cont D stand, cont C (north) cost zone	499	732	3,980	13,513	12,041	22,821	6,071	2,636	434	10,971	2,653	2,042	1,082	3,285	8,797	7,547	4,151	1,370	1,783	1,089	5,375	5,632	9,860
Incidental C volume, cont D stand, cont C (south) cost zone	16,585	9,796	1,988	1,628	2,666	5,697	9,345	10,575	1,983	3,113	5,611	1,771	1,665	4,609	5,099	2,648	1,722	0	566	10,117	4,859	4,242	5,186
Incidental D volume, Cont C stand, cont D cost zone	24,209	21,732	19,434	18,024	16,530	20,737	9,518	20,127	1,439	11,634	17,742	18,385	21,663	13,506	14,698	23,835	10,304	19,112	9,798	28,923	17,067	16,692	17,663

6.2.1 Long Run Sustained Yield (LRSY)

Long Run Sustained Yield (LRSY) is the theoretical maximum harvest level attainable from a fully regulated forest and involves harvesting stands at the age of maximum mean annual increment (MAI). In practice, long term average harvest levels will always be less than LRSY due to a variety of ecological and policy factors. Nevertheless, LRSY provides a useful benchmark against which to compare realized harvest levels.

The age of maximum MAI for FMU P19 was calculated based on total volume since this FMU utilizes a dissolved landbase.

Strict transition to pre-harvest strata ensured LRSY did not decline over time. LRSY was thus calculated by multiplying the initial net area in each yield strata by the maximum MAI for that yield strata. The LRSY values are presented in Table 6-2.

Table 6-2 Long Run Sustained Yield by FMU

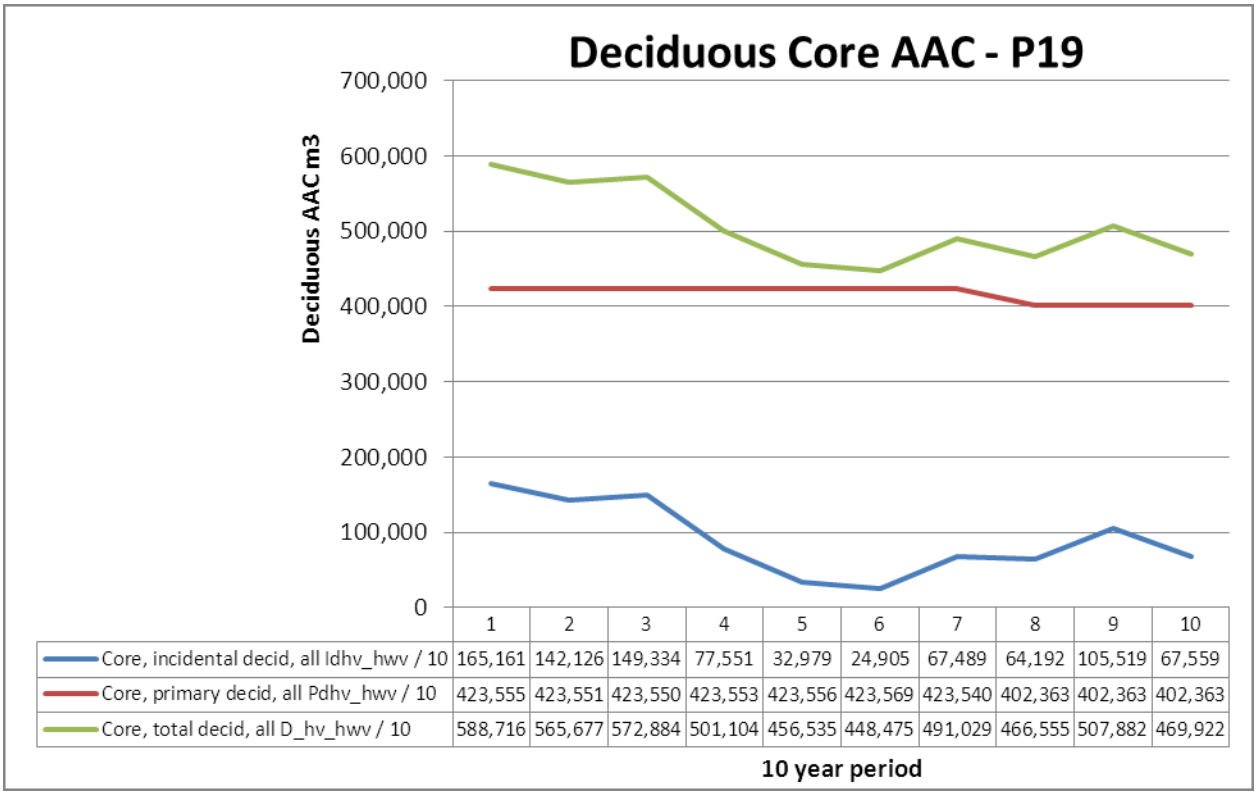
FMU	Net Area (ha)	LRSY (m^3/yr)		
		Coniferous	Deciduous	Total
P19N	120,951	114,505	240,733	355,238
P19S	376,688	471,116	576,213	1,047,329
P19 Total	497,639	585,621	816,946	1,402,567

6.3 Indicators

Annex 4 of the Alberta Forest Management Planning Standard (version 4.1 – April 2006) identifies mandatory values, objectives, indicators and targets (VOITs) to be included in Forest Management Plans.

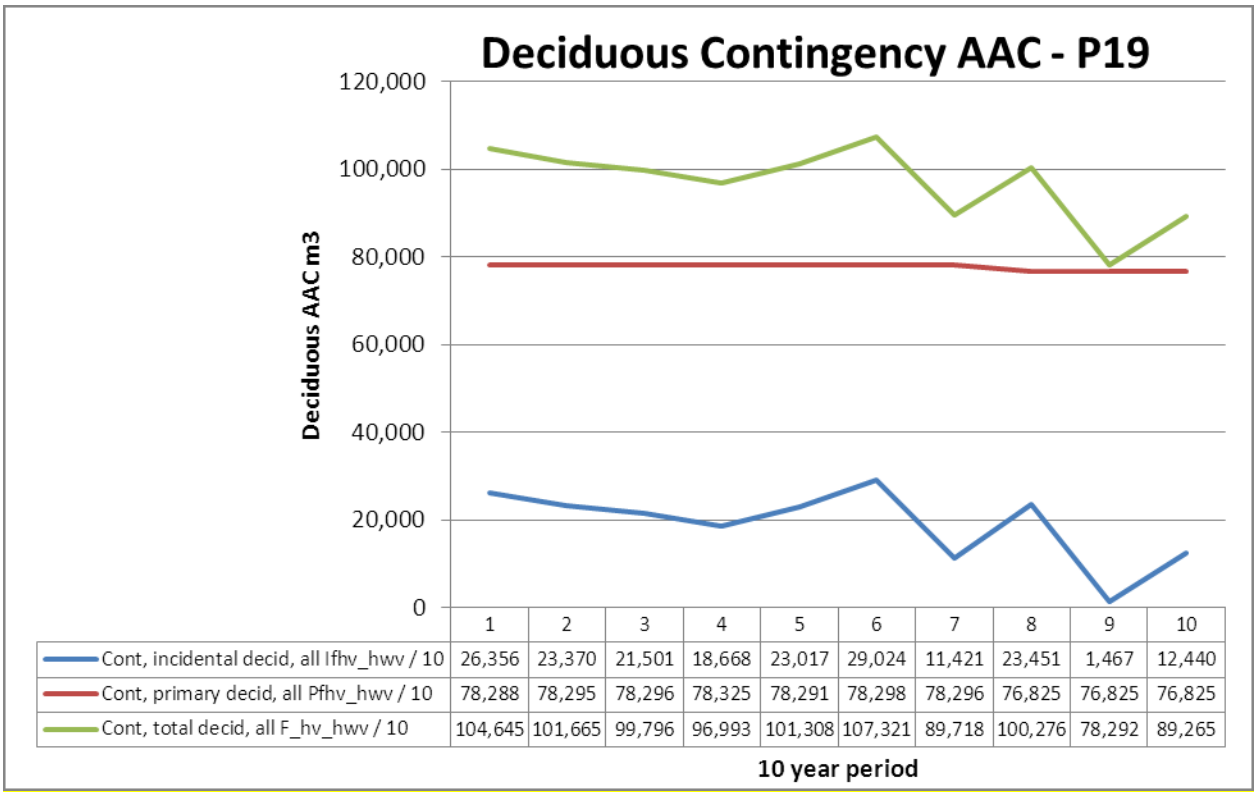
The following sections contain the main indicators, summarized across the FMA. The levels of indicators (specifically seral stages, patch sizes, interior old forest and fire behaviour potential) will be the targets for variance reporting.

6.3.1 Harvest Volume



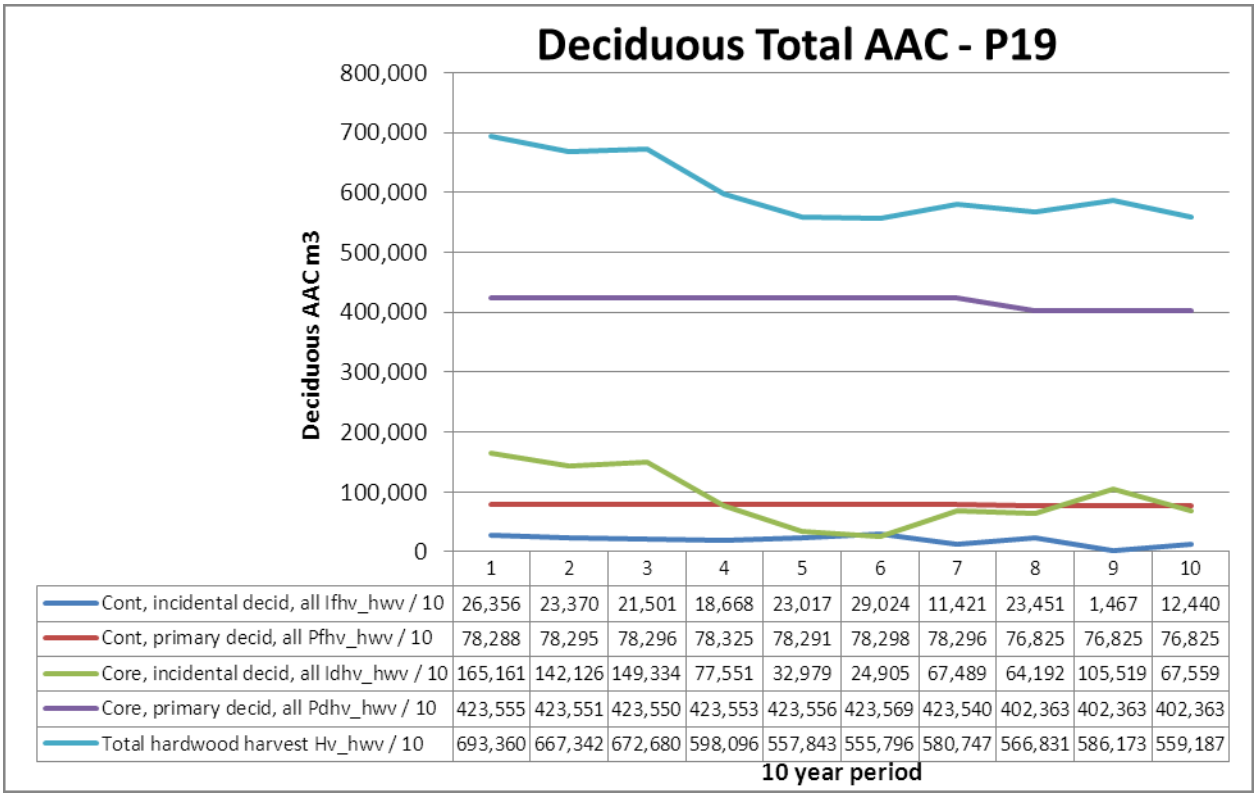
	1	2	3	4	5	6	7	8	9	10
Core, incidental decid, all Idhv_hwv / 10	165,161	142,126	149,334	77,551	32,979	24,905	67,489	64,192	105,519	67,559
Core, primary decid, all Pdhv_hwv / 10	423,555	423,551	423,550	423,553	423,556	423,569	423,540	402,363	402,363	402,363
Core, total decid, all D_hv_hwv / 10	588,716	565,677	572,884	501,104	456,535	448,475	491,029	466,555	507,882	469,922

Figure 4. Deciduous Core AAC for all of FMU P19 combined.



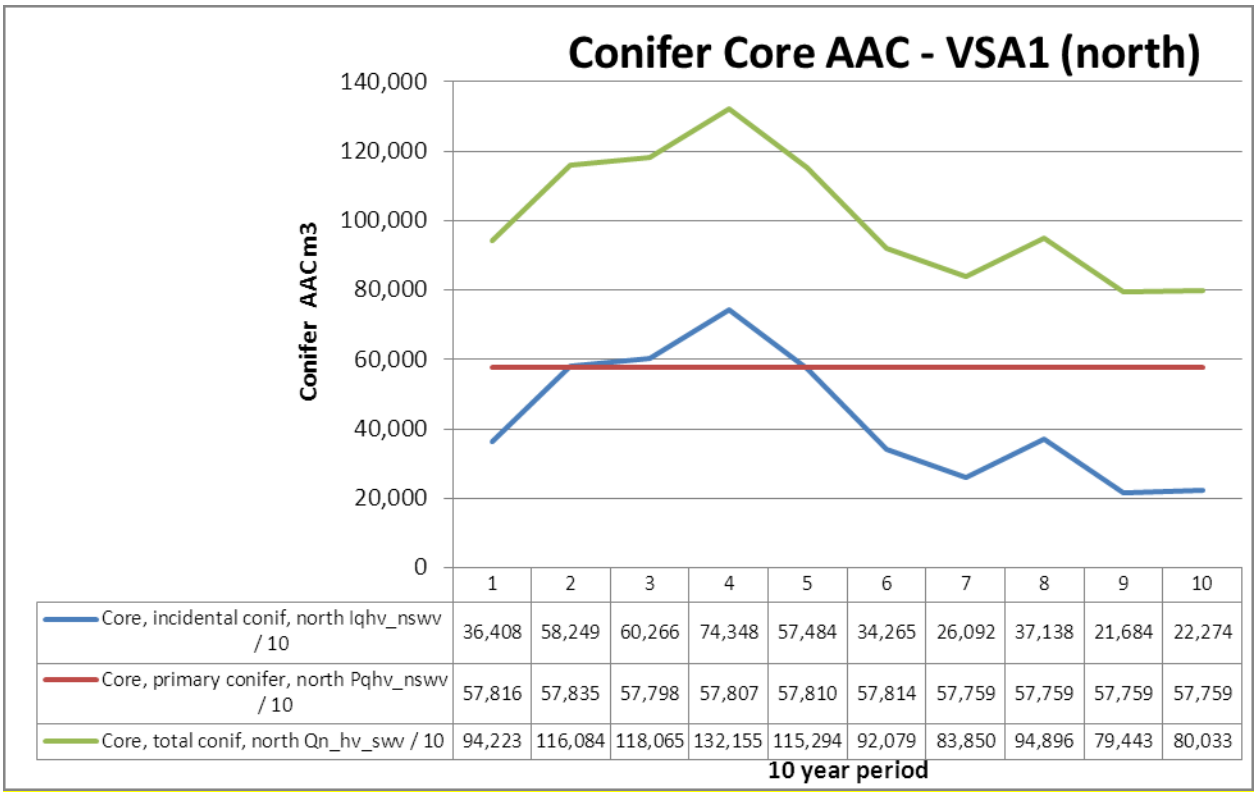
	1	2	3	4	5	6	7	8	9	10
Cont, incidental decid, all Ifhv_hwv / 10	26,356	23,370	21,501	18,668	23,017	29,024	11,421	23,451	1,467	12,440
Cont, primary decid, all Pfhv_hwv / 10	78,288	78,295	78,296	78,325	78,291	78,298	78,296	76,825	76,825	76,825
Cont, total decid, all F_hv_hwv / 10	104,645	101,665	99,796	96,993	101,308	107,321	89,718	100,276	78,292	89,265

Figure 5. Deciduous Contingency AAC for all of FMU P19 combined.



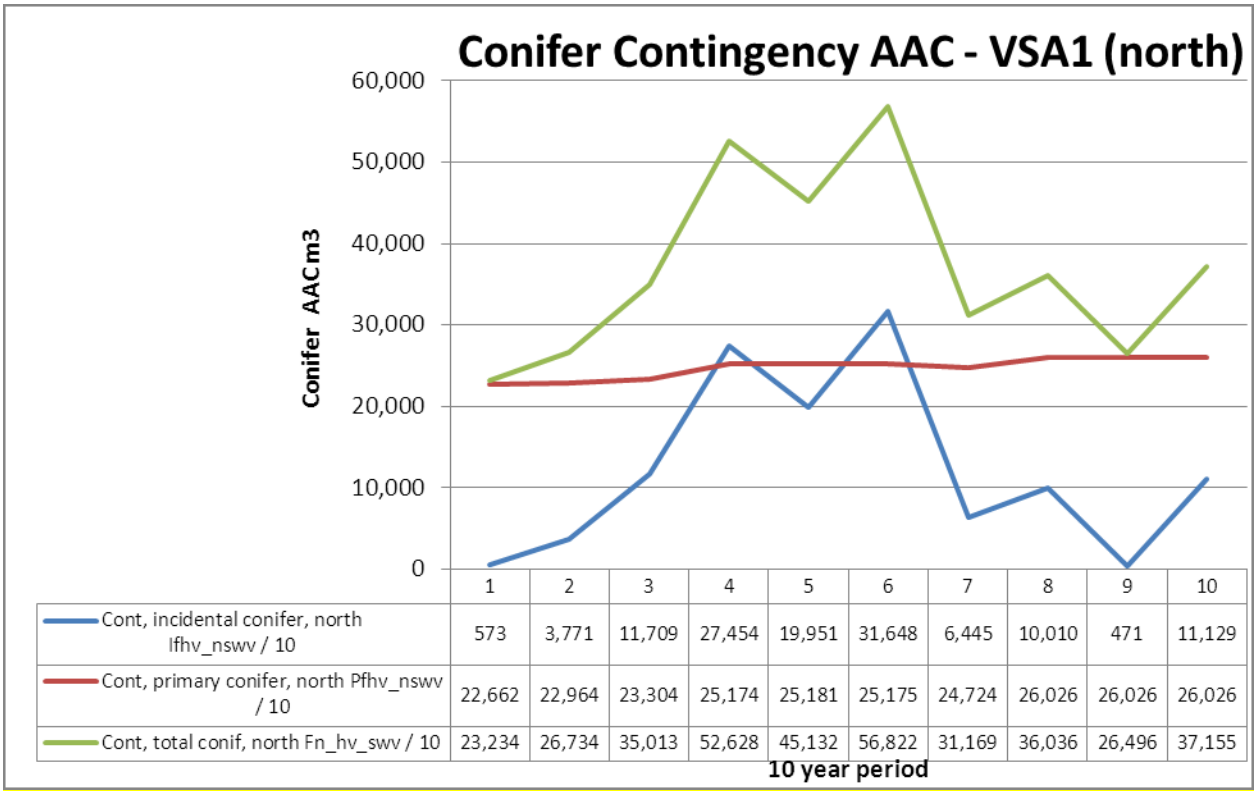
	1	2	3	4	5	6	7	8	9	10
Cont, incidental decid, all Ifhv_hwv / 10	26,356	23,370	21,501	18,668	23,017	29,024	11,421	23,451	1,467	12,440
Cont, primary decid, all Pfhv_hwv / 10	78,288	78,295	78,296	78,325	78,291	78,298	78,296	76,825	76,825	76,825
Core, incidental decid, all Idhv_hwv / 10	165,161	142,126	149,334	77,551	32,979	24,905	67,489	64,192	105,519	67,559
Core, primary decid, all Pdhv_hwv / 10	423,555	423,551	423,550	423,553	423,556	423,569	423,540	402,363	402,363	402,363
Total hardwood harvest Hv_hwv / 10	693,360	667,342	672,680	598,096	557,843	555,796	580,747	566,831	586,173	559,187

Figure 6. Total Deciduous AAC from all sources for FMU P19.



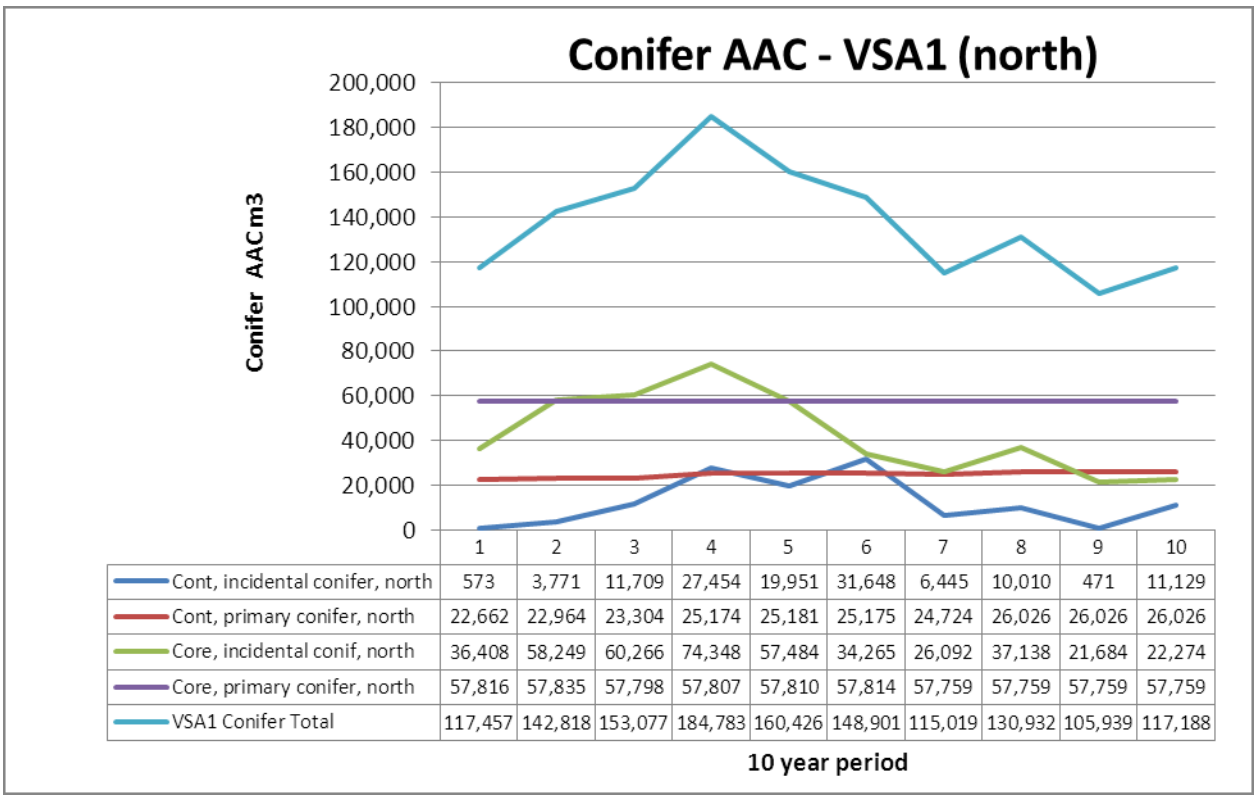
	1	2	3	4	5	6	7	8	9	10
Core, incidental conif, north Iqhv_nswv / 10	36,408	58,249	60,266	74,348	57,484	34,265	26,092	37,138	21,684	22,274
Core, primary conifer, north Pqhv_nswv / 10	57,816	57,835	57,798	57,807	57,810	57,814	57,759	57,759	57,759	57,759
Core, total conif, north Qn_hv_swv / 10	94,223	116,084	118,065	132,155	115,294	92,079	83,850	94,896	79,443	80,033

Figure 7. Conifer Core AAC for VSA1 (north).



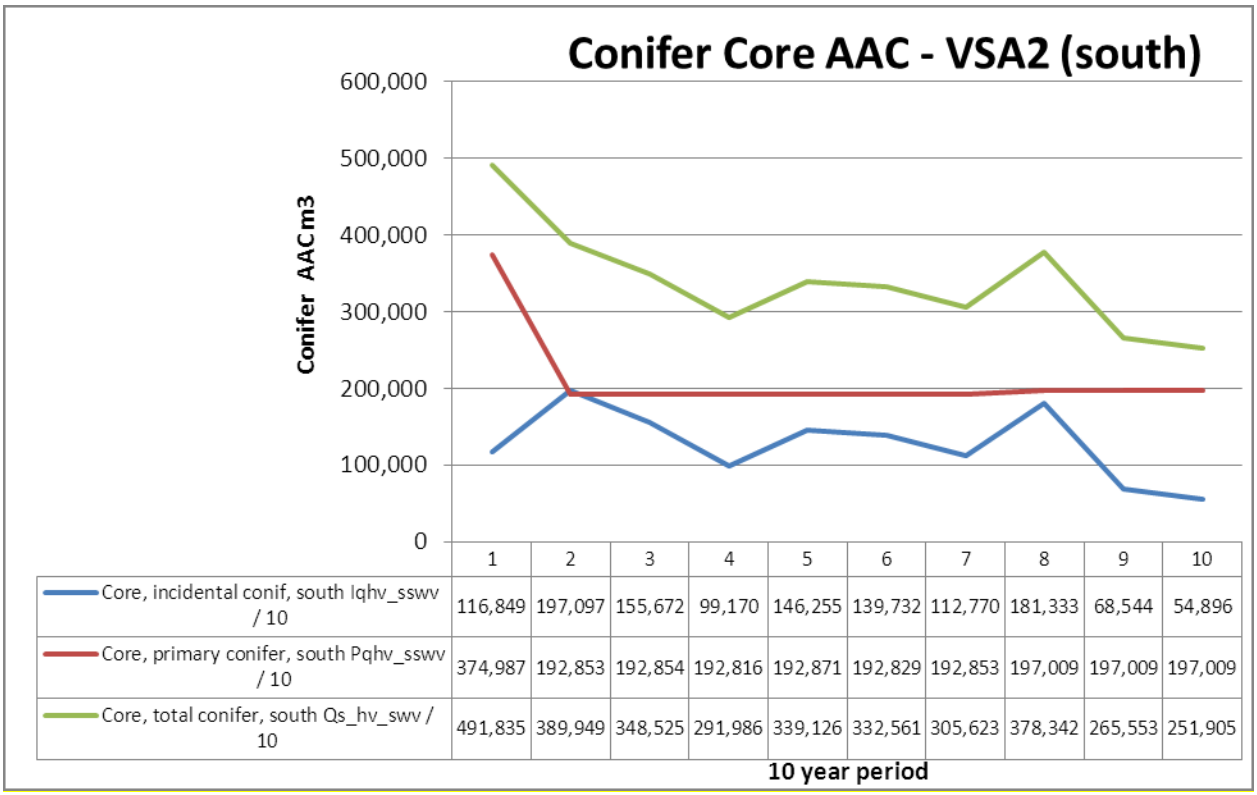
	1	2	3	4	5	6	7	8	9	10
Cont, incidental conifer, north Ifhv_nswv / 10	573	3,771	11,709	27,454	19,951	31,648	6,445	10,010	471	11,129
Cont, primary conifer, north Pfhv_nswv / 10	22,662	22,964	23,304	25,174	25,181	25,175	24,724	26,026	26,026	26,026
Cont, total conif, north Fn_hv_swv / 10	23,234	26,734	35,013	52,628	45,132	56,822	31,169	36,036	26,496	37,155

Figure 8. Conifer Contingency AAC for VSA1 (north).



	1	2	3	4	5	6	7	8	9	10
Cont, incidental conifer, north	573	3,771	11,709	27,454	19,951	31,648	6,445	10,010	471	11,129
Cont, primary conifer, north	22,662	22,964	23,304	25,174	25,181	25,175	24,724	26,026	26,026	26,026
Core, incidental conif, north	36,408	58,249	60,266	74,348	57,484	34,265	26,092	37,138	21,684	22,274
Core, primary conifer, north	57,816	57,835	57,798	57,807	57,810	57,814	57,759	57,759	57,759	57,759
VSA1 Conifer Total	117,457	142,818	153,077	184,783	160,426	148,901	115,019	130,932	105,939	117,188

Figure 9. Total Conifer AAC from all sources in VSA1 (north).



	1	2	3	4	5	6	7	8	9	10
Core, incidental conif, south Iqhv_sswv / 10	116,849	197,097	155,672	99,170	146,255	139,732	112,770	181,333	68,544	54,896
Core, primary conifer, south Pqhv_sswv / 10	374,987	192,853	192,854	192,816	192,871	192,829	192,853	197,009	197,009	197,009
Core, total conifer, south Qs_hv_swv / 10	491,835	389,949	348,525	291,986	339,126	332,561	305,623	378,342	265,553	251,905

Figure 10. Conifer Core AAC for VSA2 (south).

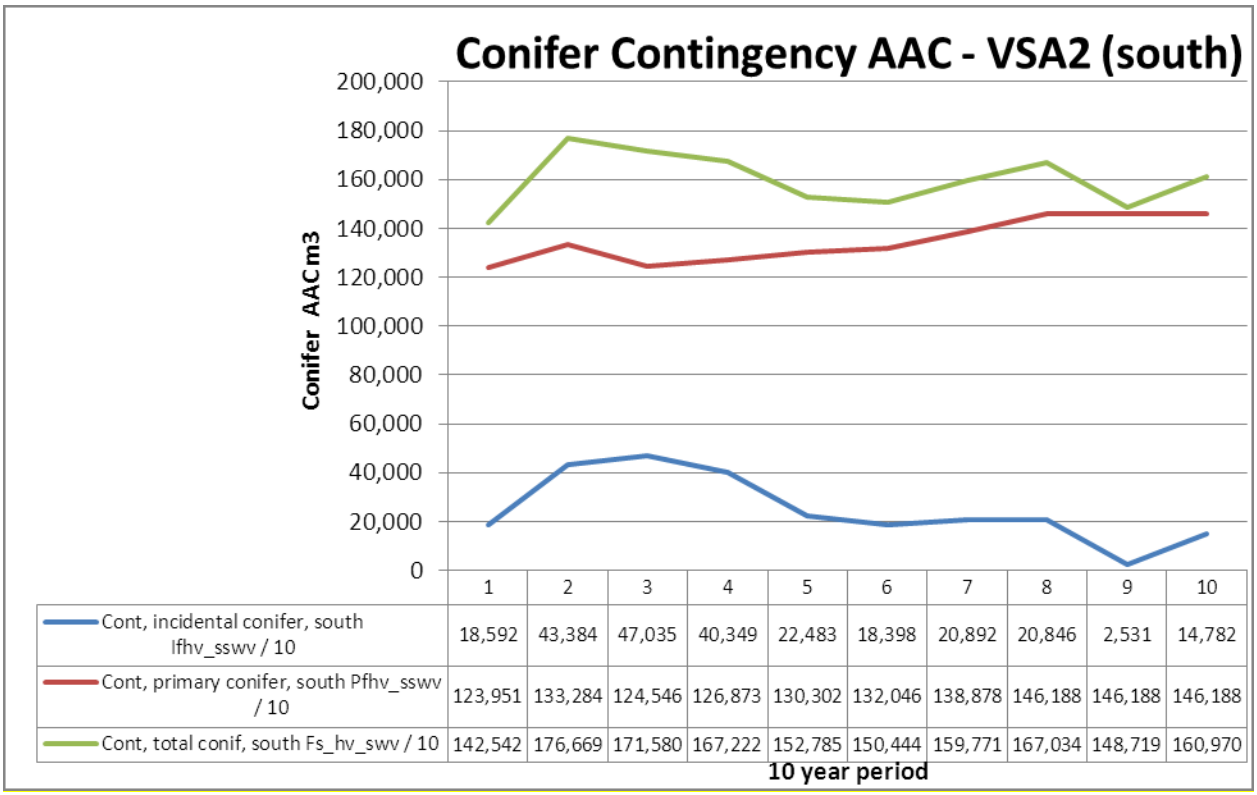
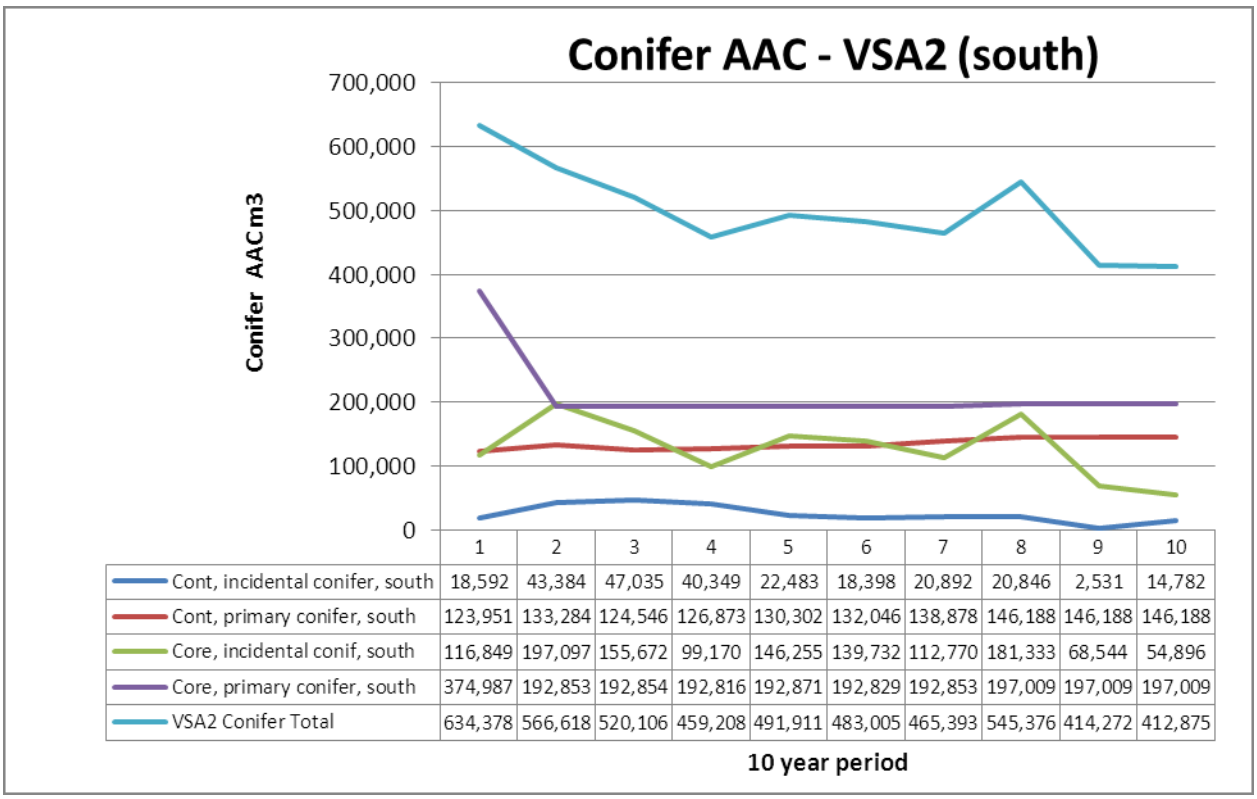
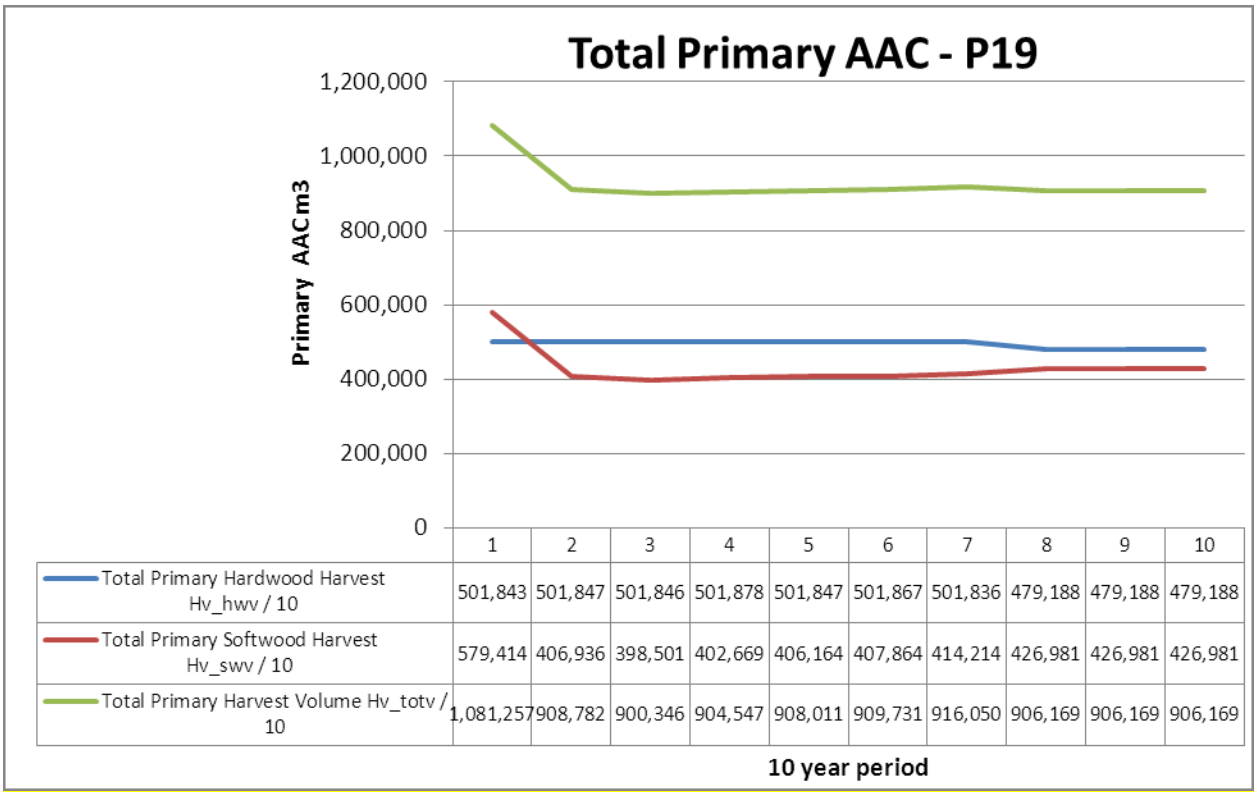


Figure 11. Conifer Contingency AAC for VSA2 (south).



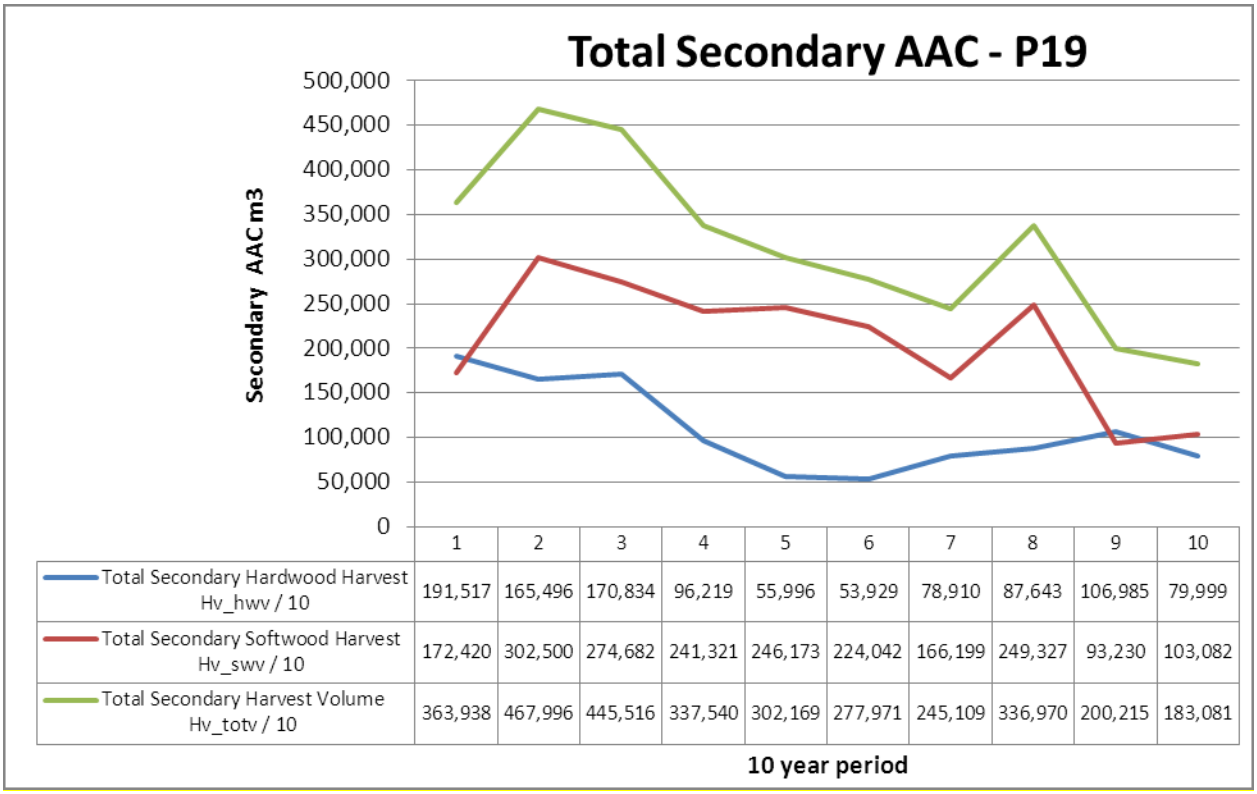
	1	2	3	4	5	6	7	8	9	10
Cont, incidental conifer, south	18,592	43,384	47,035	40,349	22,483	18,398	20,892	20,846	2,531	14,782
Cont, primary conifer, south	123,951	133,284	124,546	126,873	130,302	132,046	138,878	146,188	146,188	146,188
Core, incidental conif, south	116,849	197,097	155,672	99,170	146,255	139,732	112,770	181,333	68,544	54,896
Core, primary conifer, south	374,987	192,853	192,854	192,816	192,871	192,829	192,853	197,009	197,009	197,009
VSA2 Conifer Total	634,378	566,618	520,106	459,208	491,911	483,005	465,393	545,376	414,272	412,875

Figure 12. Total Conifer AAC from all sources in VSA2(south).



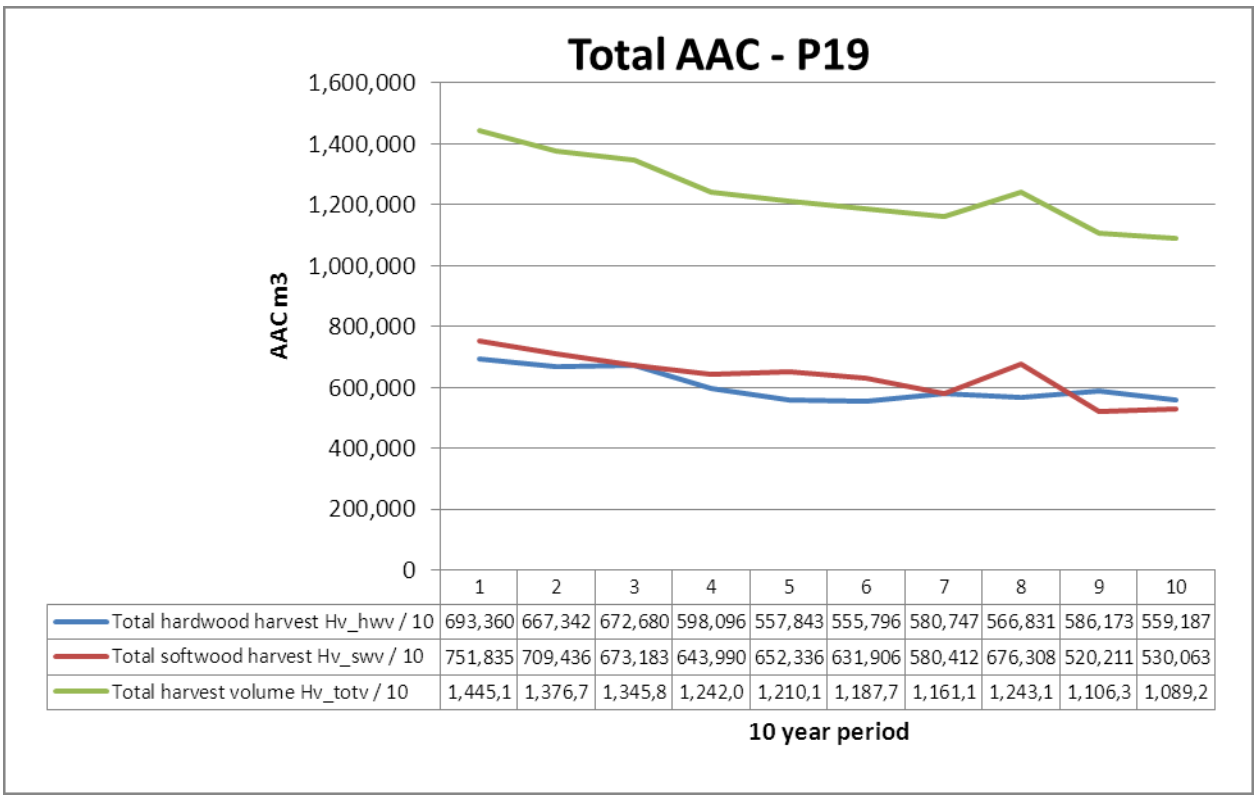
	1	2	3	4	5	6	7	8	9	10
Total Primary Hardwood Harvest Hv_hwv / 10	501,843	501,847	501,846	501,878	501,847	501,867	501,836	479,188	479,188	479,188
Total Primary Softwood Harvest Hv_swv / 10	579,414	406,936	398,501	402,669	406,164	407,864	414,214	426,981	426,981	426,981
Total Primary Harvest Volume Hv_totv / 10	1,081,257	908,782	900,346	904,547	908,011	909,731	916,050	906,169	906,169	906,169

Figure 13. Total Primary AAC for FMU P19.



	1	2	3	4	5	6	7	8	9	10
Total Secondary Hardwood Harvest Hv_hwv / 10	191,517	165,496	170,834	96,219	55,996	53,929	78,910	87,643	106,985	79,999
Total Secondary Softwood Harvest Hv_swv / 10	172,420	302,500	274,682	241,321	246,173	224,042	166,199	249,327	93,230	103,082
Total Secondary Harvest Volume Hv_totv / 10	363,938	467,996	445,516	337,540	302,169	277,971	245,109	336,970	200,215	183,081

Figure 14. Total Secondary AAC for FMU P19.



	1	2	3	4	5	6	7	8	9	10
Total hardwood harvest Hv_hwv / 10	693,360	667,342	672,680	598,096	557,843	555,796	580,747	566,831	586,173	559,187
Total softwood harvest Hv_swv / 10	751,835	709,436	673,183	643,990	652,336	631,906	580,412	676,308	520,211	530,063
Total harvest volume Hv_totv / 10	1,445,1	1,376,7	1,345,8	1,242,0	1,210,1	1,187,7	1,161,1	1,243,1	1,106,3	1,089,2

Figure 15. Total AAC for FMU P19.

6.3.2 Growing Stock

Operable growing stock was constrained to be non-declining over the last quarter (50 years) of the planning horizon, consistent with Section 5.8(A)(iii) of the Planning Standard. A constraint was placed on hardwood operable growing stock. Softwood operable growing stock constraints were applied to P19N (VSA1) and P19S (VSA2) independently.

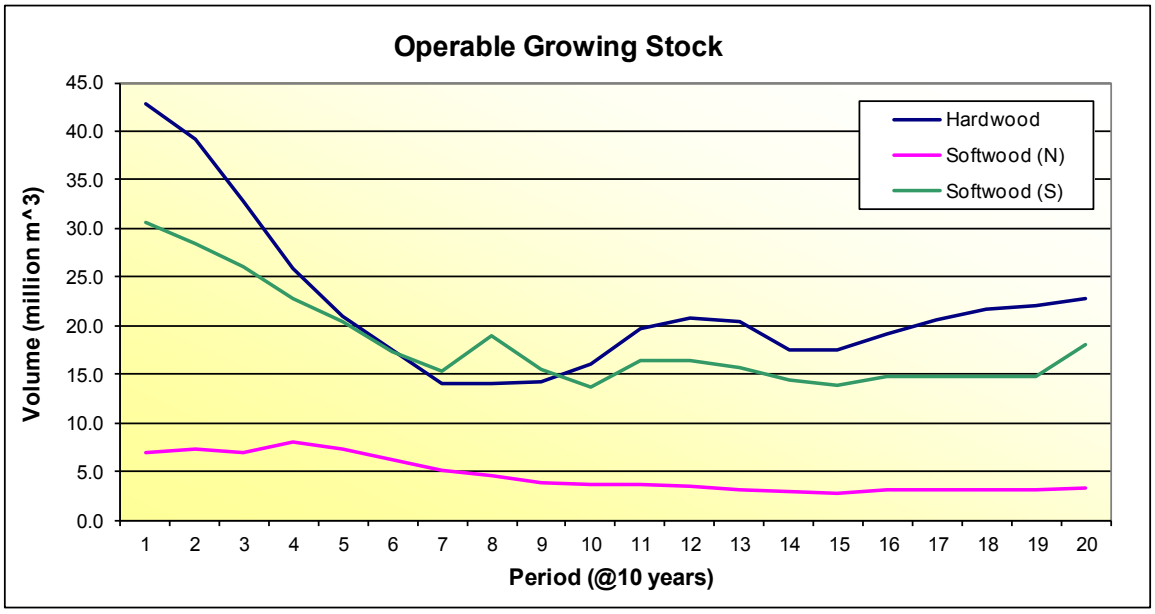


Figure 16. P19 Operable Growing Stock

6.3.3 Piece Size

Harvested piece size (trees/m^3) is shown in the following figures to ensure no precipitous declines occur over the planning horizon, as per Section 5.9.10 of the Planning Standard. Piece size generally increases throughout the planning horizon, reflecting the shift in age class towards a fully managed forest.

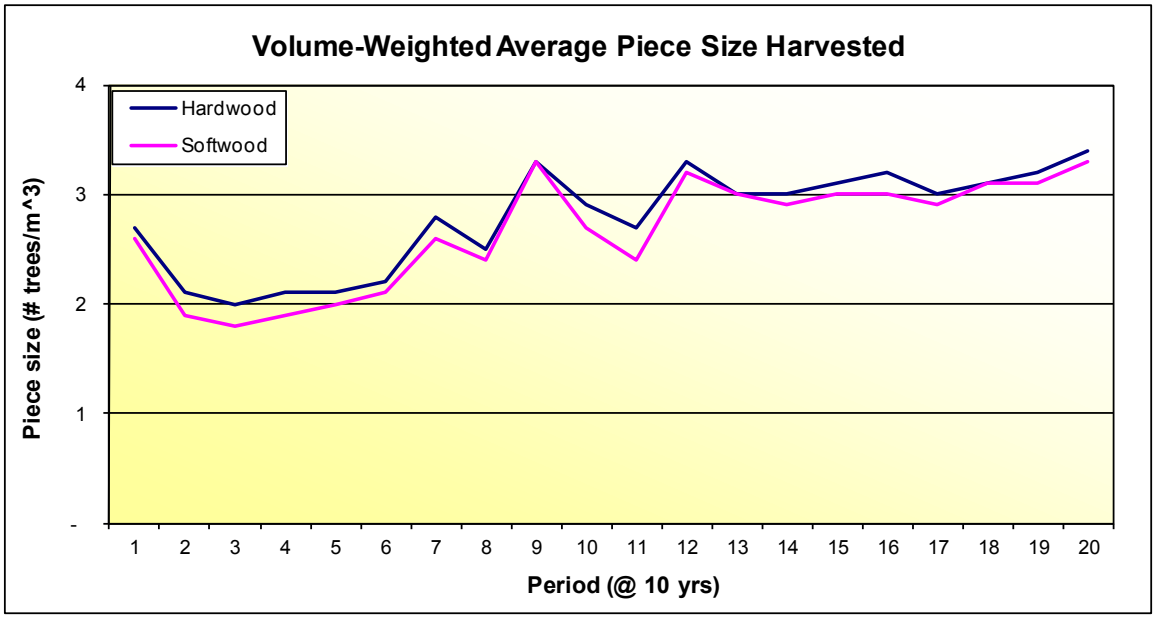


Figure 17. P19 Harvested Piece Size on Deciduous Landbase

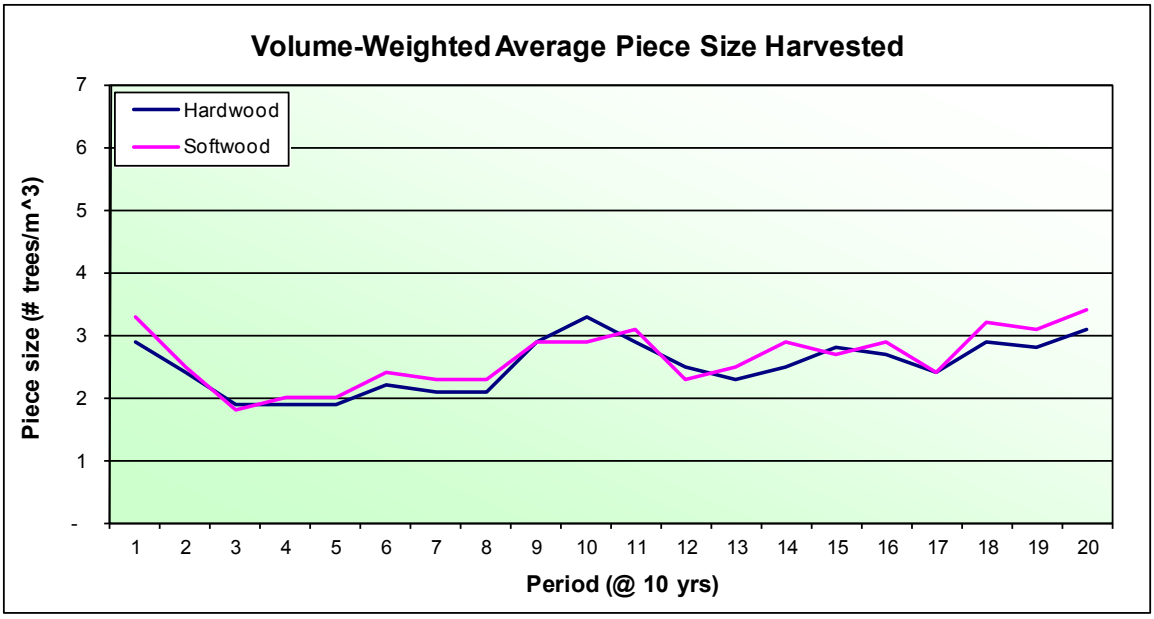


Figure 18. P19 Harvested Piece Size on Coniferous Landbase

6.3.4 Volume per Hectare

DMI imposed minimum volume per hectare operability limits. Volume per hectare remains relatively stable throughout the planning horizon.

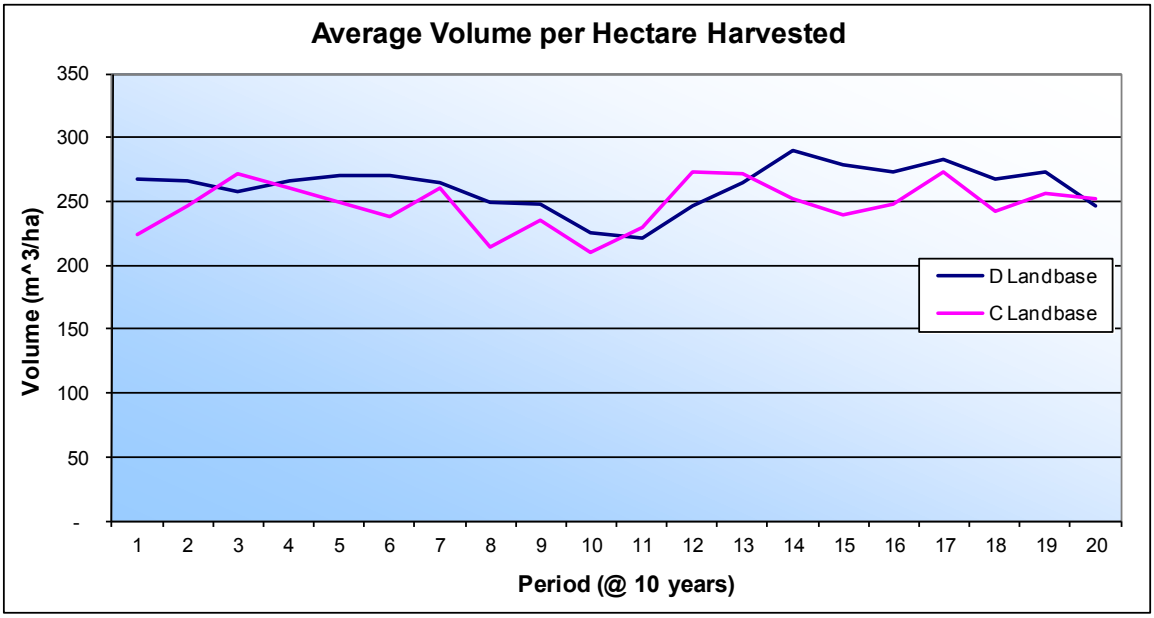


Figure 19. P19 Average Volume per Hectare Harvested

6.3.5 Harvest Age

DMI imposed a minimum harvest age for each yield stratum. Average harvest age generally declines over the planning horizon, reflecting the shift to a younger regulated forest.

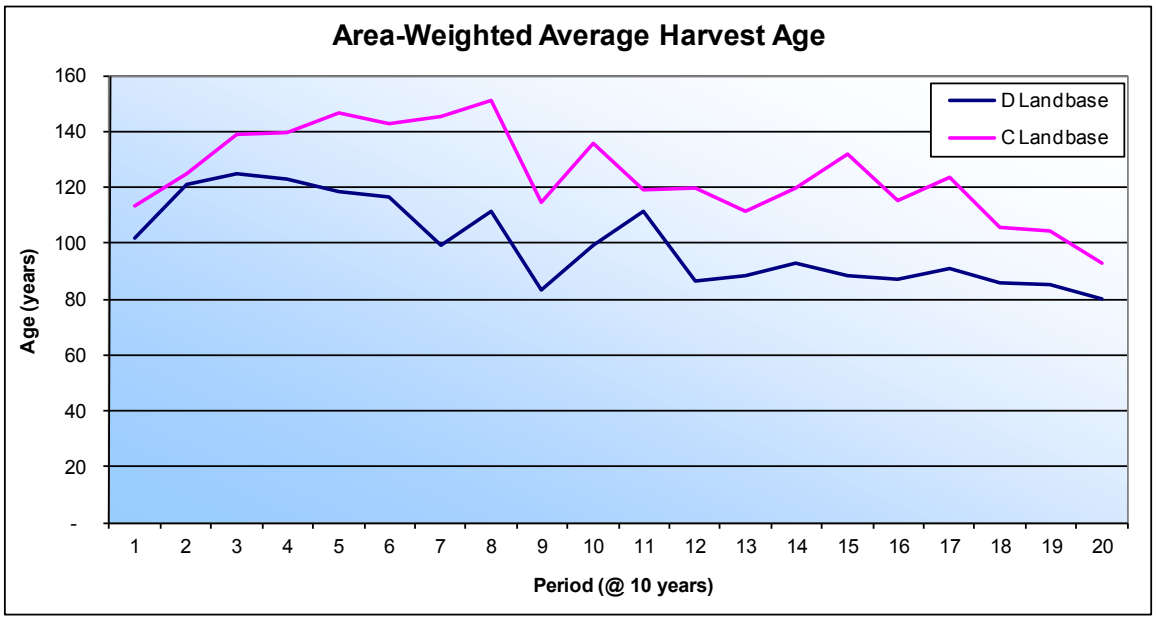


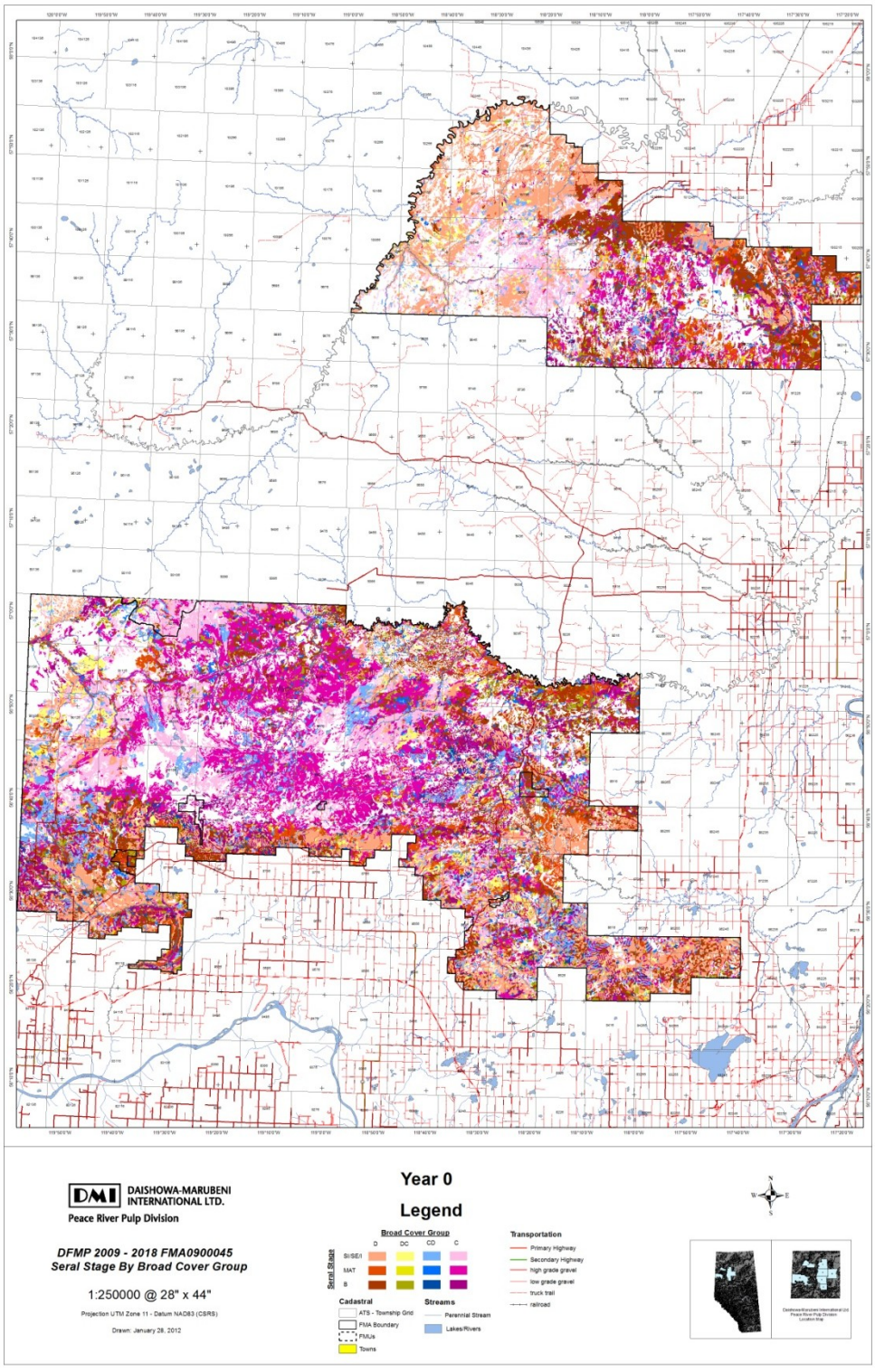
Figure 20. P19 Average Harvest Age

6.3.6 Seral Stage / Broad Cover Group

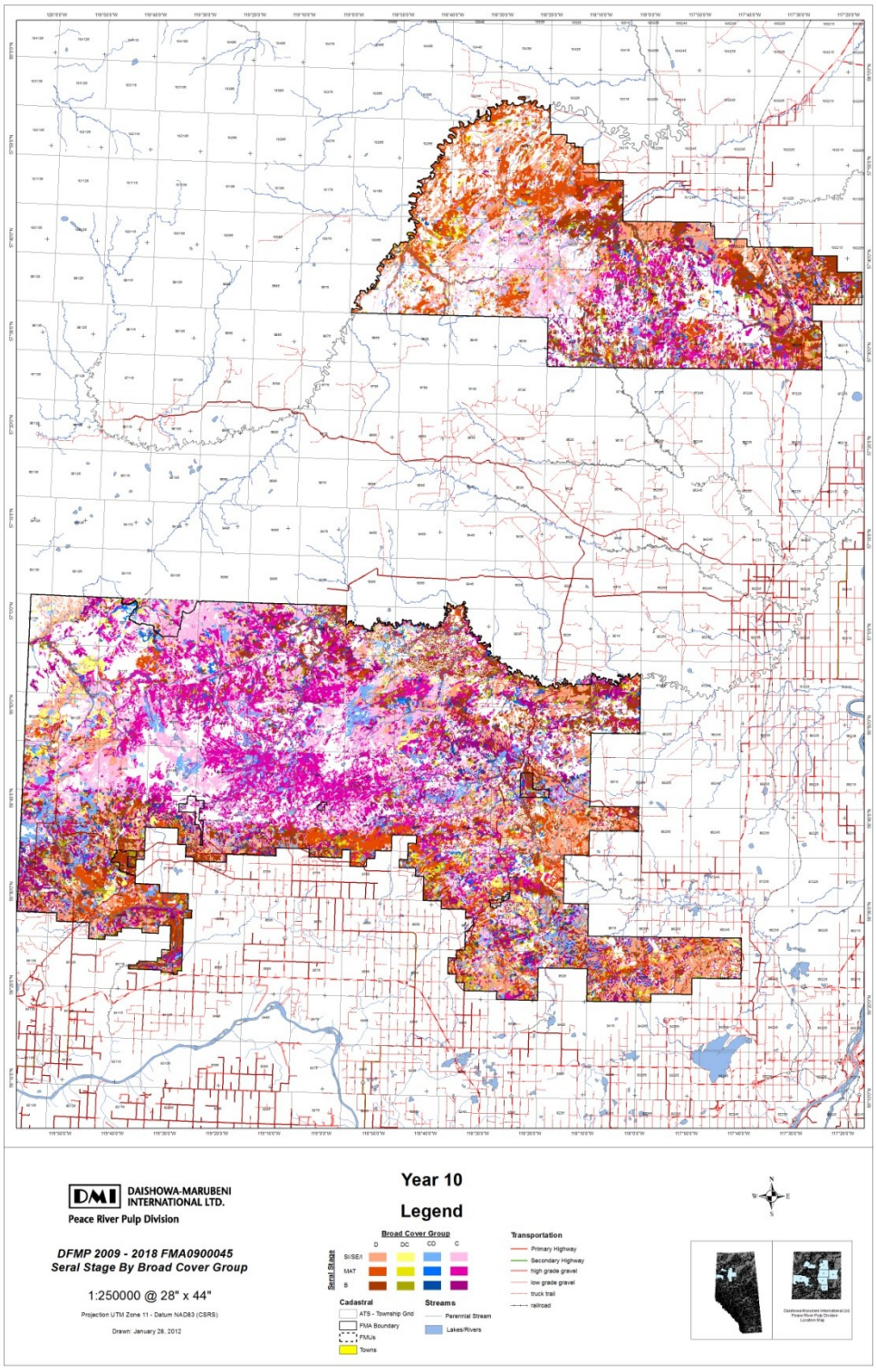
The PFMS constrained seral stage net area by 3 broad classes: C/CD Successional, D/DC Successional, and Empirical. Achieved values for these classes are shown in the following table. Long term target values are shown in Table 4-3 and forecast values are in Table 6-3.

Table 6-3 P19 Forecast Seral Stage by Broad Cover Group Area

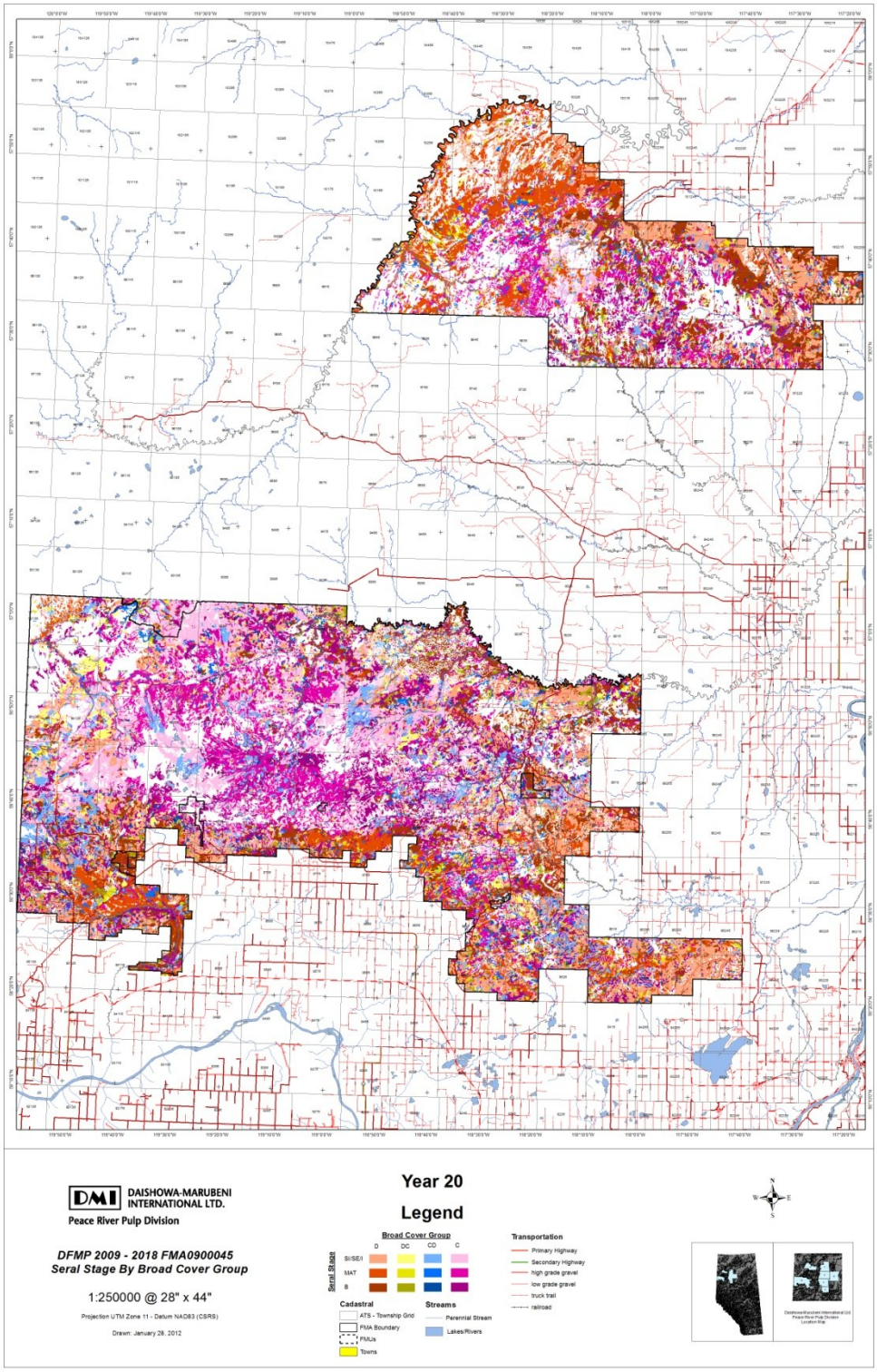
SYU	Yield Strata	Cover Group	Seral Stage	Years from Start Date				
				0	10	50	100	200
P19	Successional	D/DC	MAT	37,223	65,349	22,200	46,206	38,676
			B	101,435	92,013	49,769	20,060	40,120
		C/CD	MAT	35,363	28,825	10,266	26,480	17,692
			B	30,485	38,109	24,813	14,058	28,116
	Empirical		Old	68,134	49,338	49,527	32,506	53,910



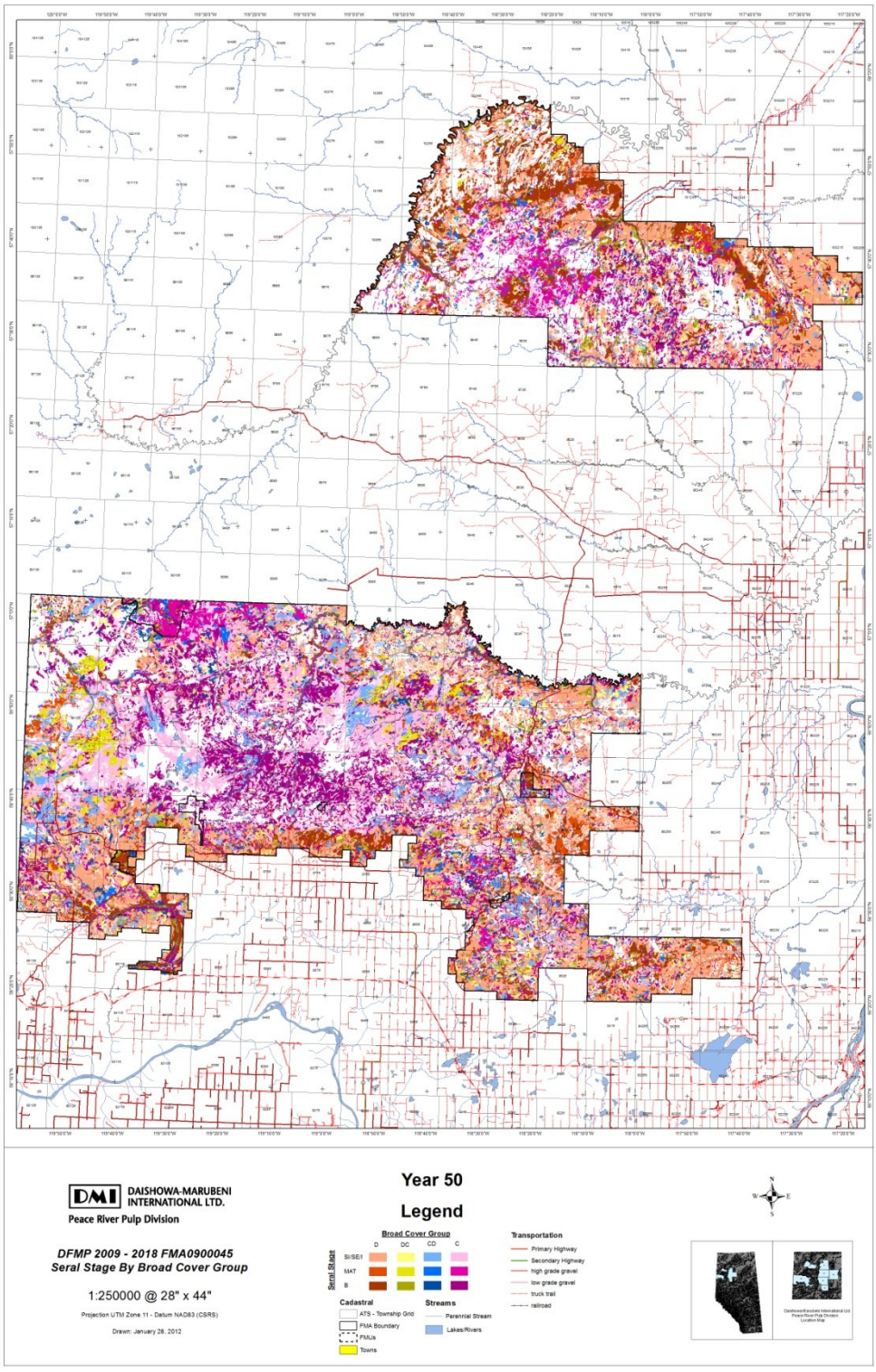
Map 1. Seral Stage by Broad Cover Group forecast in 2009.



Map 2. Seral Stage by Broad Cover Group forecast in 2019.



Map 3. Seral Stage by Broad Cover Group forecast in 2029.



Map 4. Seral Stage by Broad Cover Group forecast in 2059.

6.3.7 Seral Stage / Cover Class

Cover class was assigned to each polygon in order to report the area by cover class and seral stage on the gross and net landbase, as required by Objective 1.1.1.1 in Annex 4 of the Planning Standard. The use of successional yield curves in the timber supply models required a dynamic classification system that accounted for changes in broad cover group over time. The D (deciduous) broad cover group was treated as a single cover class. The DC (deciduous-dominant mixedwood) cover group was broken into 2 classes by leading species: DC-Sw (white spruce leading) and DC-Pj (pine leading). The CD (coniferous-dominant mixedwood) and C (coniferous) cover groups were joined together consistent with the landbase classification scheme. In addition to white spruce and pine subclasses, a black spruce subclass was added (C-Sb). A generic 'conifer' cover class was required for empirical yield curves that did not distinguish between leading conifer species. The following tables outline the cover class assignment rules which result in 7 possible cover classes: D, DC-Sw, DC-Pj, C-Sw, C-Pj, C-Sb, and CON. The seral stage classification comes directly from the yield curves.

Table 6-4 P19 Cover Class Assignment Rules

Yield Strata	Yield Strata Description	cover class (when C/CD)	cover class (when DC)	cover class (when D)
0	No strata			
1	Aspen>>Shrub			D
2	Aspen>>WhiteSpruce		DC-Sw	D
3	Aspen>>LateMixed>>Wspruce	C-Sw	DC-Sw	D
4	Aspen>>EarlyMixed>>Wspruce	C-Sw	DC-Sw	D
5	AspenMixed>>Wspruce	C-Sw	DC-Sw	
6	Wspruce>>Wspruce	C-Sw		
7	Pine	C-Pj		
8	Pine-BlackSpruce-Deciduous	CON		
9	Deciduous-Pine-BlackSpruce		DC-Pj	
10	Pine-Wspruce	CON		
11	BalsamPoplar>>Shrub			D
12	BlackSpruce-Pine/WSpruce	C-Sb		
13	Black Spruce	C-Sb		

The following tables show the area by cover class and seral stage on the gross and net landbase. The 'Year 10' values represent the short-term target areas (+/- 10%) for each cover class and seral stage.

Table 6-5 P19 Area by Seral Stage and Cover Class

Year 0

Gross Landbase		Seral Stage SI	SE	I	MAT	B	Sum
Cover Class	D	10,529	34,725	89,656	39,253	101,117	275,280
	DC-Sw	9	3,639	7,422	4,082	17,107	32,259
	DC-Pj	8	7,012	4,255	2,472	6,291	20,038
	C-Sw	18,929	1,822	13,133	43,848	36,292	114,024
	C-Pj	358	22,305	21,039	37,163	3,784	84,649
	C-Sb	253	7,826	24,261	56,033	7,619	95,992
	CON	178	14,236	10,973	22,558	7,720	55,665
	None	-	-	-	-	-	79,036
Sum		30,265	91,566	170,737	205,409	179,930	756,942

Net Landbase		Seral Stage SI	SE	I	MAT	B	Sum
Cover Class	D	10,437	30,959	63,481	33,667	85,945	224,489
	DC-Sw	3	3,361	6,624	3,556	15,490	29,033
	DC-Pj	-	5,521	3,607	2,227	6,003	17,357
	C-Sw	18,074	1,342	10,132	35,363	30,485	95,395
	C-Pj	279	21,351	18,808	35,645	3,598	79,680
	C-Sb	-	-	-	-	-	-
	CON	94	13,549	9,944	20,835	7,264	51,686
	None	-	-	-	-	-	-
Sum		28,887	76,082	112,595	131,291	148,785	497,640

Year 10

Gross Landbase		Seral Stage SI	SE	I	MAT	B	Sum
Cover Class	D	26,884	25,373	48,396	77,899	95,178	273,728
	DC-Sw	3,071	670	6,355	6,701	16,236	33,033
	DC-Pj	2,967	52	8,573	4,143	4,303	20,038
	C-Sw	10,477	11,614	10,266	36,295	46,151	114,803
	C-Pj	16,034	22,404	17,303	26,152	2,756	84,649
	C-Sb	2,425	7,417	13,452	61,648	11,050	95,992
	CON	6,368	14,187	7,772	19,705	7,633	55,665
	None	-	-	-	-	-	79,036
Sum		68,225	81,717	112,115	232,542	183,307	756,943

Net Landbase		Seral Stage SI	SE	I	MAT	B	Sum
Cover Class	D	26,521	24,166	36,153	59,290	77,414	223,544
	DC-Sw	3,071	597	5,621	6,059	14,598	29,947
	DC-Pj	2,967	28	6,868	3,548	3,946	17,357
	C-Sw	10,387	10,491	7,613	28,825	38,109	95,426
	C-Pj	15,979	21,427	15,208	24,594	2,473	79,681
	C-Sb	-	-	-	-	-	-
	CON	6,322	13,515	6,867	18,162	6,820	51,686
	None	-	-	-	-	-	-
Sum		65,247	70,224	78,330	140,478	143,361	497,640

Year 50

Gross Landbase		Seral Stage SI	SE	I	MAT	B	Sum
Cover Class	D	29,569	70,105	81,965	18,341	80,315	280,294
	DC-Sw	120	8,994	11,315	7,029	15,105	42,562
	DC-Pj	1,670	2,073	5,465	7,054	3,777	20,038
	C-Sw	9,007	10,966	22,648	14,020	42,066	98,707
	C-Pj	13,569	25,494	22,229	12,504	10,853	84,649
	C-Sb	-	2,289	7,580	13,499	72,623	95,992
	CON	2,202	8,234	14,020	7,986	23,223	55,665
	None	-	-	-	-	-	79,036
Sum		56,136	128,156	165,222	80,433	247,960	756,943

Net Landbase		Seral Stage SI	SE	I	MAT	B	Sum
Cover Class	D	29,569	70,105	80,464	15,492	39,166	234,796
	DC-Sw	120	8,994	11,211	6,708	10,603	37,636
	DC-Pj	1,670	2,073	5,441	5,563	2,610	17,357
	C-Sw	9,007	10,966	21,433	10,266	24,813	76,485
	C-Pj	13,569	25,494	21,212	10,394	9,012	79,680
	C-Sb	-	-	-	-	-	-
	CON	2,202	8,234	13,320	7,063	20,868	51,686
	None	-	-	-	-	-	-
Sum		56,136	125,866	153,080	55,485	107,072	497,640

Year 100

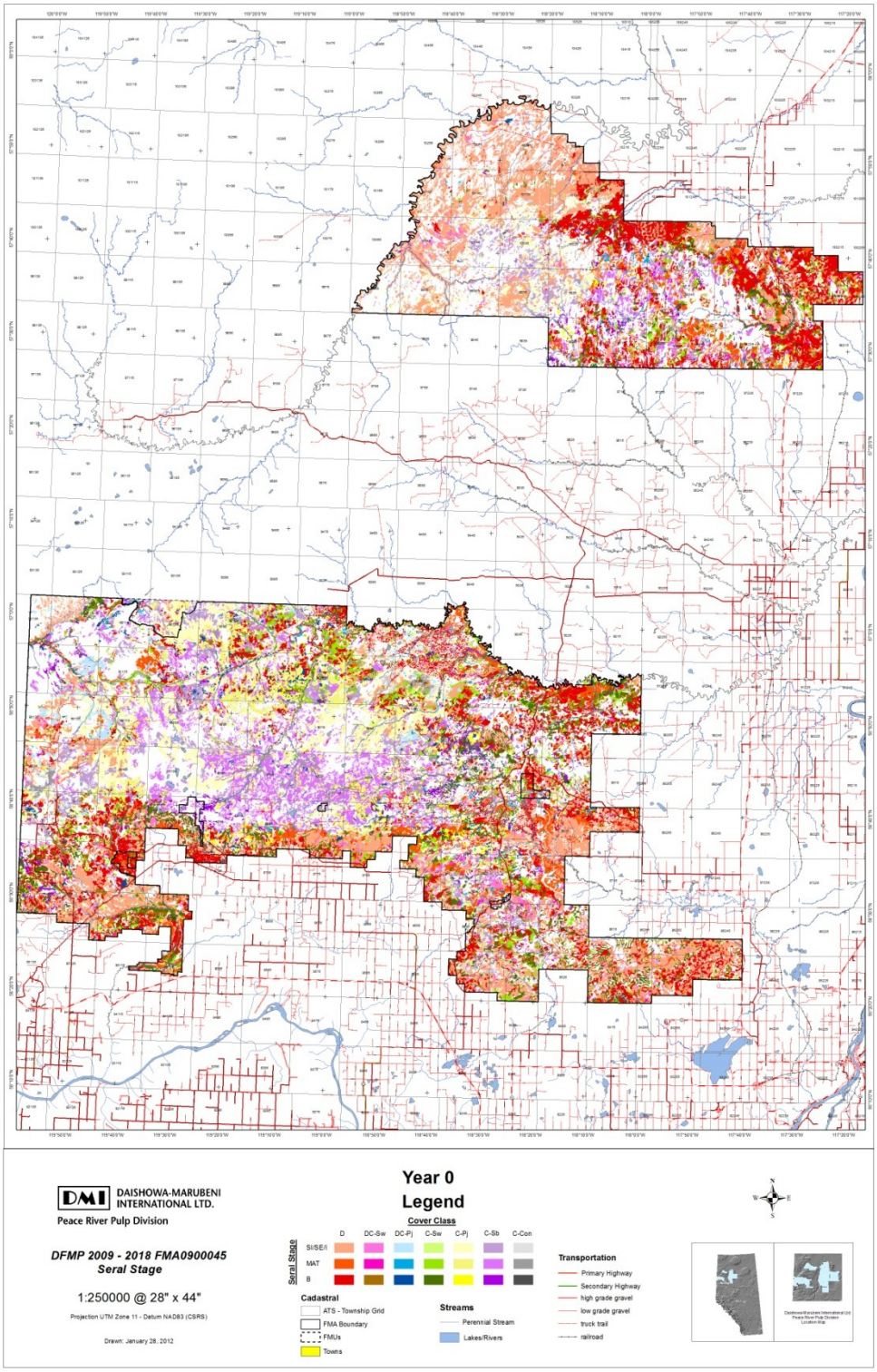
Gross Landbase		Seral Stage SI	SE	I	MAT	B	Sum
Cover Class	D	26,600	50,768	108,067	38,490	58,016	281,942
	DC-Sw	2,578	1,949	9,530	7,745	10,532	32,335
	DC-Pj	26	6,877	3,696	3,739	5,701	20,038
	C-Sw	8,754	12,698	22,822	27,545	35,468	107,288
	C-Pj	18,516	22,133	15,709	23,433	4,859	84,649
	C-Sb	2,073	98	-	2,541	91,279	95,992
	CON	14,765	19,435	2,323	8,239	10,903	55,664
	None	-	-	-	-	-	79,036
Sum		73,314	113,958	162,147	111,732	216,757	756,942

Net Landbase		Seral Stage SI	SE	I	MAT	B	Sum
Cover Class	D	26,300	50,483	108,044	38,460	14,235	237,522
	DC-Sw	2,577	1,949	9,530	7,745	5,825	27,627
	DC-Pj	15	6,877	3,696	3,739	3,031	17,357
	C-Sw	7,789	12,620	22,822	26,480	14,058	83,768
	C-Pj	18,465	22,129	15,709	23,354	23	79,680
	C-Sb	-	-	-	-	-	-
	CON	14,684	19,407	2,323	8,154	7,118	51,686
	None	-	-	-	-	-	-
Sum		69,831	113,463	162,124	107,933	44,290	497,640

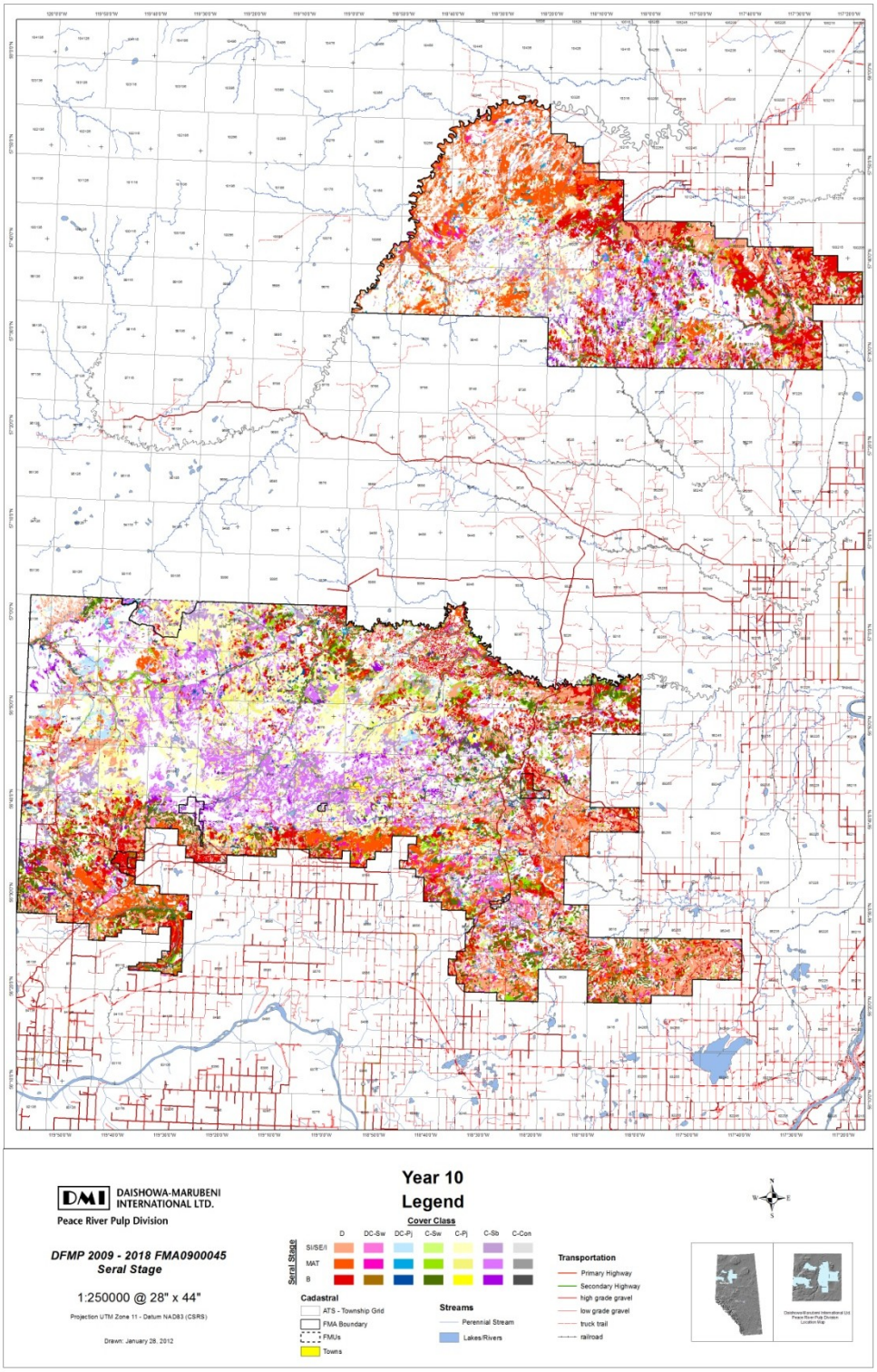
Year 200

Gross Landbase		Seral Stage SI	SE	I	MAT	B	Sum
Cover Class	D	40,659	68,078	104,044	19,776	45,014	277,570
	DC-Sw	10,347	2,805	6,116	19,841	1,667	40,775
	DC-Pj	205	3,606	4,504	1,223	10,500	20,038
	C-Sw	14,733	19,697	16,423	21,610	30,756	103,218
	C-Pj	12,167	27,739	24,577	19,130	1,036	84,649
	C-Sb	13,002	41,370	26,216	4,939	10,465	95,992
	CON	11,444	7,114	10,061	18,156	8,890	55,665
	None	-	-	-	-	-	79,036
Sum		102,555	170,408	191,941	104,675	108,328	756,942

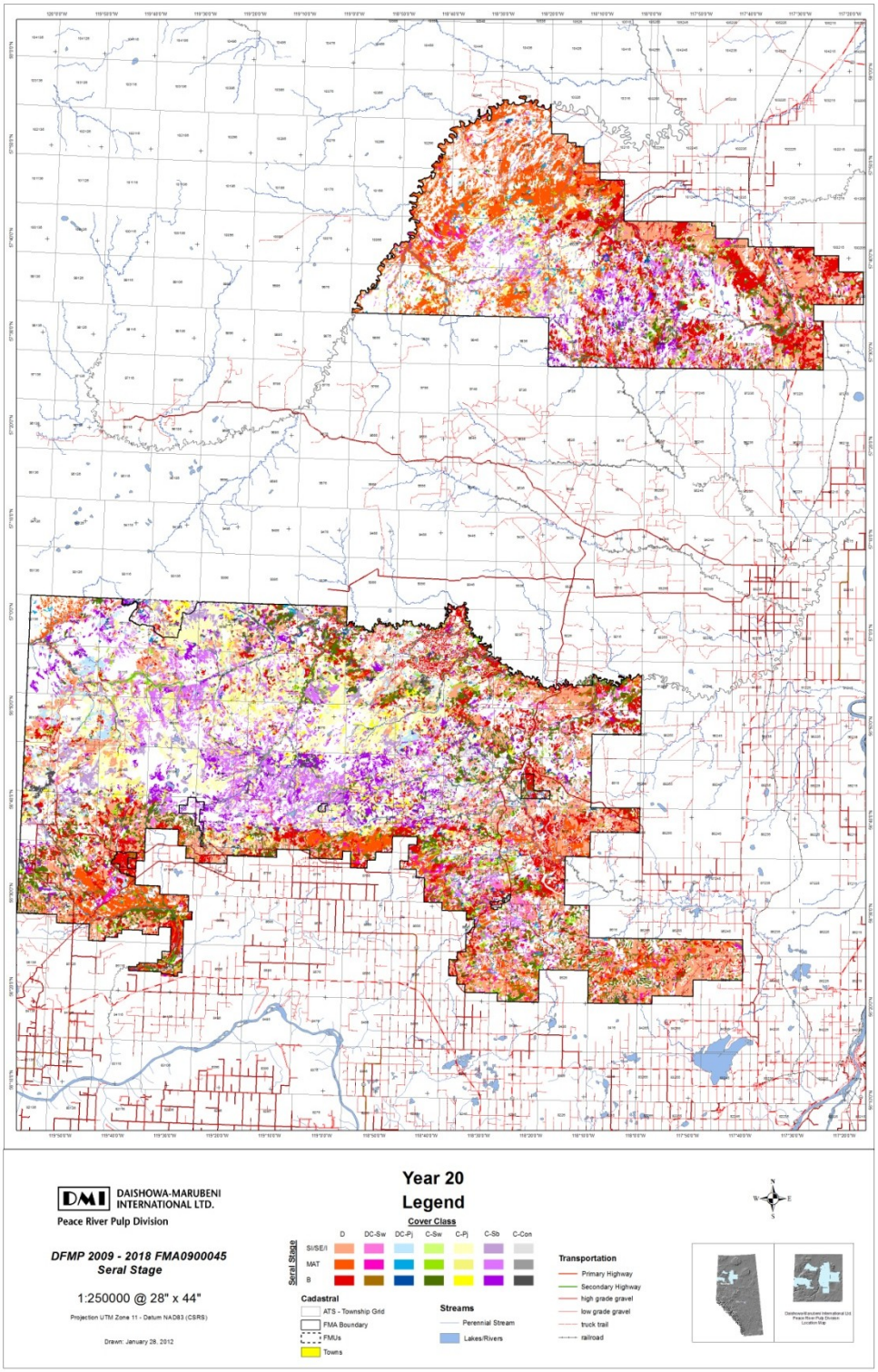
Net Landbase		Seral Stage SI	SE	I	MAT	B	Sum
Cover Class	D	33,195	48,827	84,709	19,125	38,664	224,520
	DC-Sw	10,041	2,247	5,115	19,552	1,456	38,410
	DC-Pj	-	3,011	4,179	1,208	8,958	17,357
	C-Sw	12,940	16,601	10,638	17,692	28,116	85,987
	C-Pj	10,072	26,968	23,615	19,026	-	79,680
	C-Sb	-	-	-	-	-	-
	CON	10,592	6,254	8,915	17,836	8,090	51,686
	None	-	-	-	-	-	-
Sum		76,839	103,908	137,170	94,438	85,285	497,640



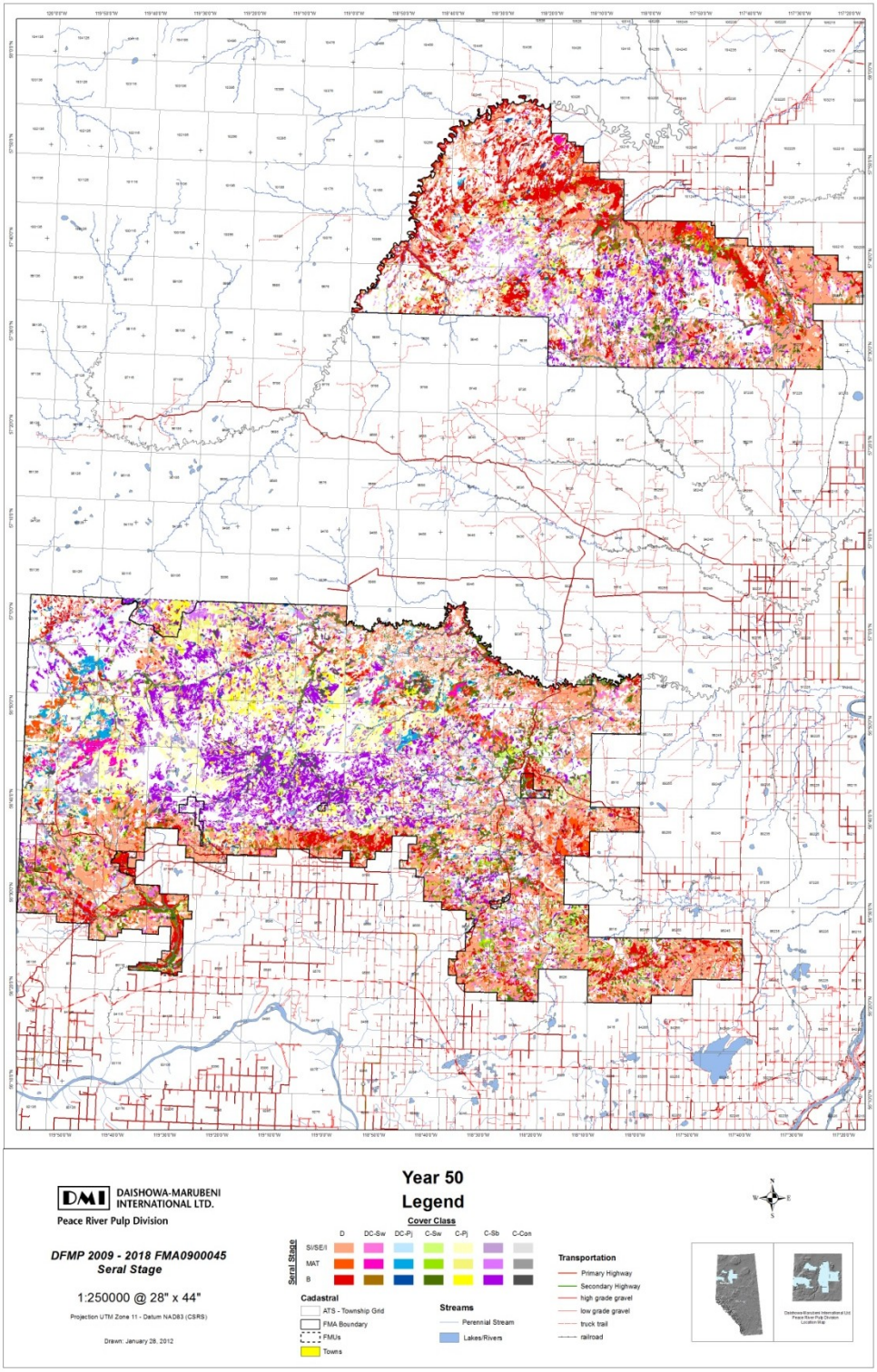
Map 5. Seral stage by cover class forecast in 2009.



Map 6. Seral stage by cover class forecast in 2019.



Map 7. Seral stage by cover class forecast in 2029.



Map 8. Seral stage by cover class forecast in 2059.

6.3.8 Age Class Distribution

The following figures illustrate the age class distribution of the net landbase for the PFMS at 0 (present), 10, 20 and 50 years in the future, by broad cover group. The graphs show the gradual harvest of older age classes, progressing towards a managed forest.

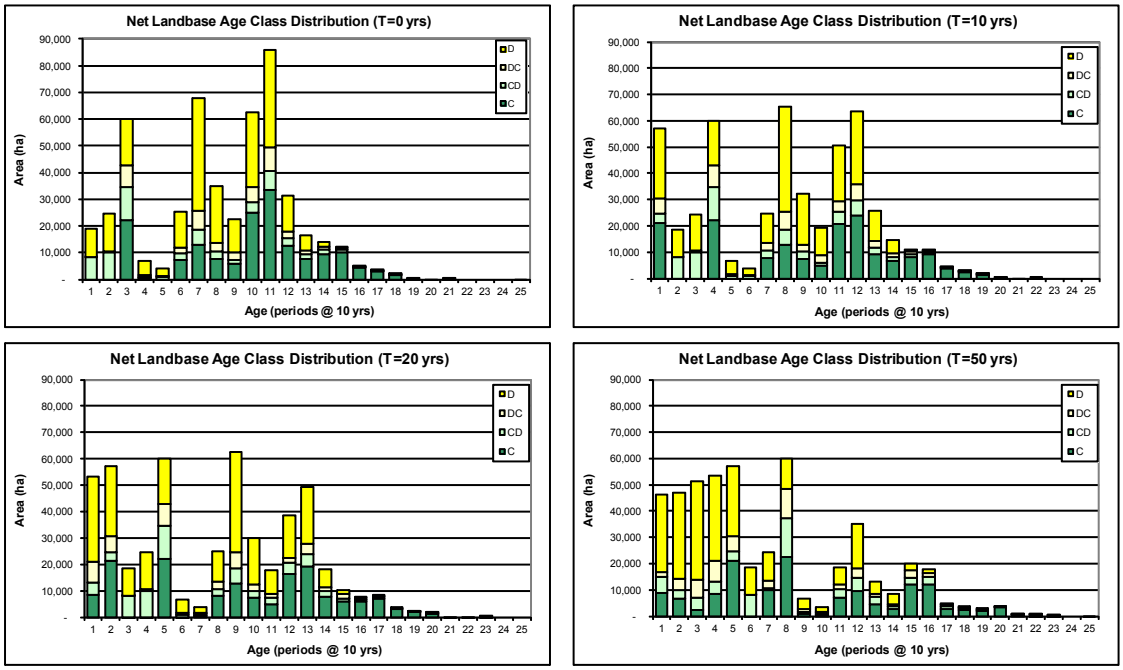


Figure 21. P19 Net Landbase Age Class Distribution

6.3.9 Patch Size By Seral Stage Distribution

The following forest patch forecasts are derived from the Patchworks simulation discussed in Section 3.4. All forecasts are derived from the final spatial playback of the preferred forest management scenario.

Patch size distribution was analyzed at year 0 (initial), 10 (end of period 1), 20 (end of period 2) and 50 (end of period 5). The following tables show the area of forest in each patch size class across the FMA. The total area excludes buffers on linear features and hence does not sum to the gross forested area shown in other tables. The tables indicate a shift towards younger seral stages and smaller patch sizes.

Table 6-6. PatchSize / Seral Stage Distribution at time 0, 10, 50 for FMA west.

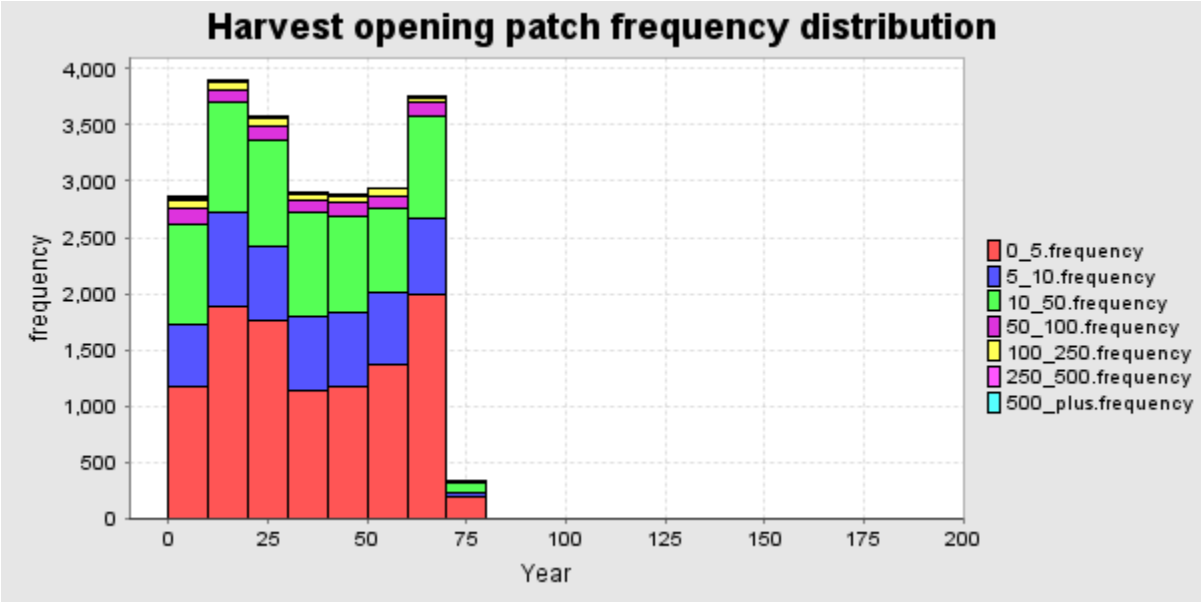
		Seral Stage					
	Year 0	**SI**	**SE**	**I**	**MAT**	**B**	**SUM**
Patch Size	0-5	1,128	1,915	3,822	6,027	5,247	18,138
	5-10	2,157	2,460	5,678	9,255	8,149	27,698
	10-40	13,130	14,898	17,117	27,472	27,739	100,356
	40-100	7,490	9,567	17,470	22,087	23,422	80,036
	100-500	5,269	9,222	26,508	38,486	41,049	120,534
	500+	1,021	53,506	96,207	99,431	71,590	321,754
	SUM	30,195	91,567	166,801	202,757	177,196	668,517

		Seral Stage					
	Year 10	**SI**	**SE**	**I**	**MAT**	**B**	**SUM**
Patch Size	0-5	1,808	1,729	3,518	6,956	6,495	20,506
	5-10	4,766	2,716	5,715	10,087	8,848	32,132
	10-40	19,360	18,466	19,168	30,727	27,824	115,546
	40-100	14,250	12,222	15,855	29,284	22,277	93,888
	100-500	18,323	14,024	22,845	48,841	37,176	141,208
	500+	9,690	32,522	41,391	104,305	77,330	265,238
	SUM	68,197	81,678	108,492	230,200	179,950	668,517

		Seral Stage					
	Year 50	**SI**	**SE**	**I**	**MAT**	**B**	**SUM**
Patch Size	0-5	2,049	3,722	2,971	3,134	9,483	21,359
	5-10	6,005	8,925	6,615	5,307	11,259	38,111
	10-40	18,056	30,784	27,239	18,207	35,890	130,177
	40-100	14,777	23,979	22,906	12,516	30,948	105,126
	100-500	15,244	38,111	42,233	16,803	57,097	169,488
	500+	0	22,622	63,195	21,149	97,290	204,256
	SUM	56,132	128,143	165,159	77,117	241,967	668,517

6.3.10 Harvest Opening Patches

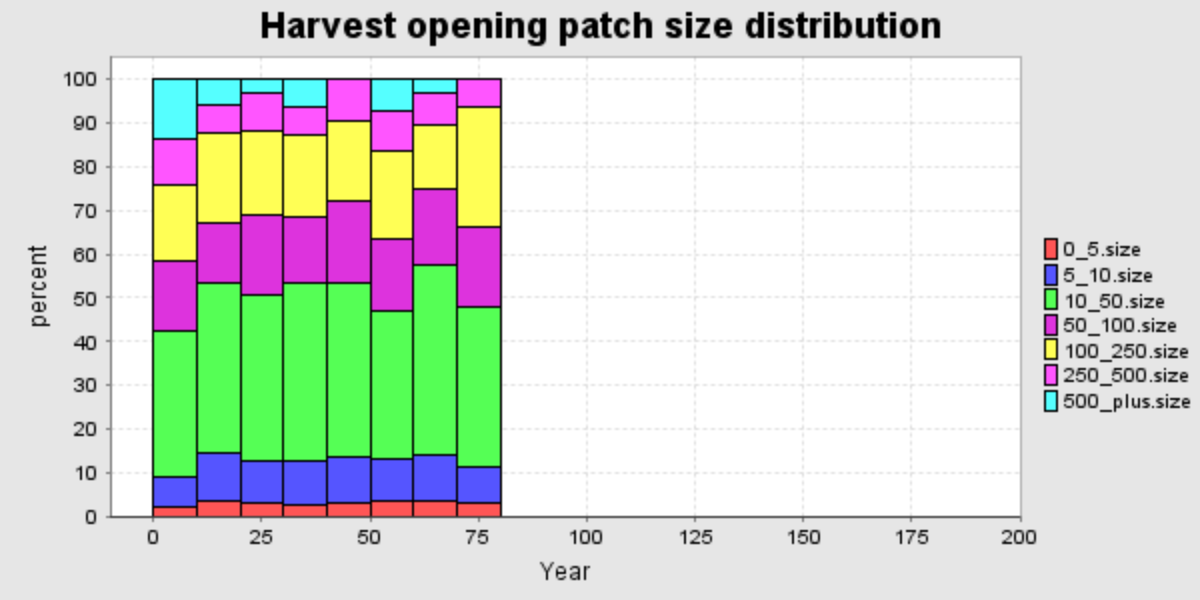
Area and frequency count distributions of harvest patches were compiled. Harvest openings are defined as the amount of contiguous area harvested in the same ten year planning period. These values are produced from the Patchworks simulation of the 70 year harvest sequence.



Openings are defined as the amount of contiguous area harvested within the same planning period.

Period	Year	patch.harvest							Total
		0_5	5_10	10_50	50_100	100_250	250_500	500_plus	
		frequency	frequency	frequency	frequency	frequency	frequency	frequency	
0	0	0	0	0	0	0	0	0	0
1	10	1,167	551	907	137	66	19	11	2,858
2	20	1,887	842	970	110	74	10	5	3,898
3	30	1,769	654	940	130	65	14	2	3,574
4	40	1,132	660	923	108	60	9	4	2,896
5	50	1,170	671	838	126	57	14	0	2,876
6	60	1,363	647	745	115	59	11	5	2,945
7	70	1,999	669	917	114	43	9	2	3,753

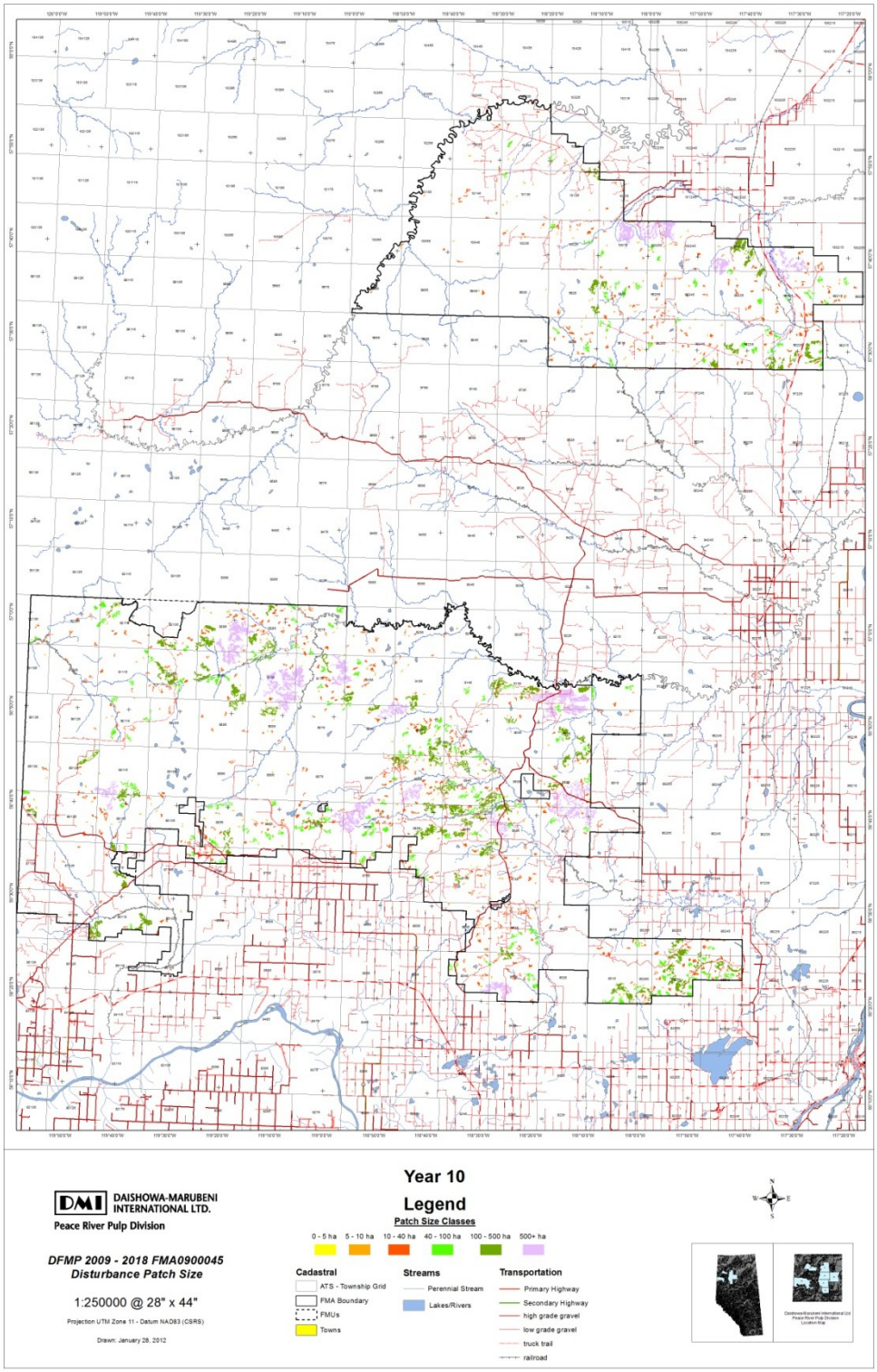
Figure 22. One Period Harvest Opening patch size frequency forecast.



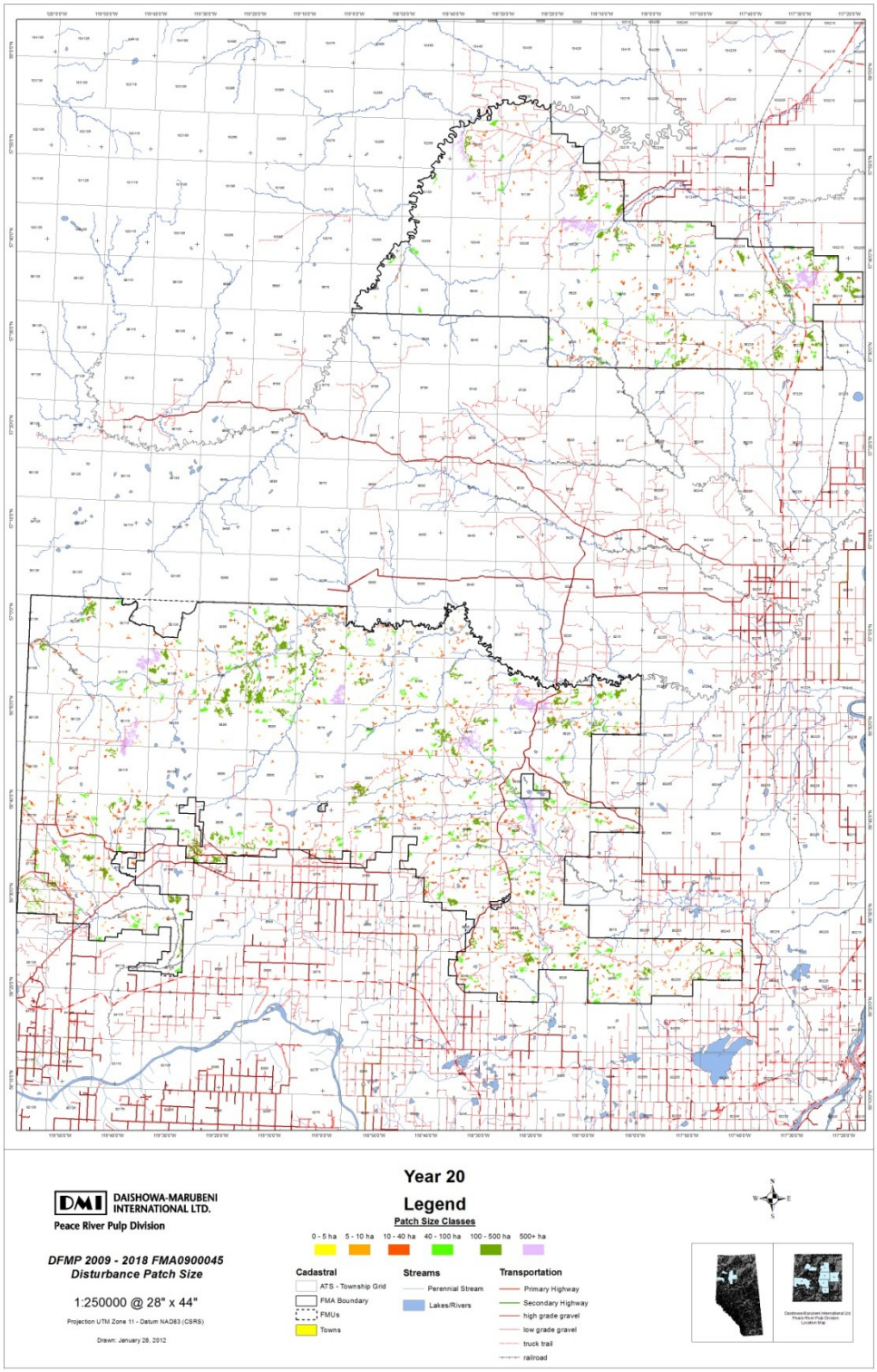
Openings are defined as the amount of contiguous area harvested within the same planning period.

Period	Year	patch.harvest							Total
		0_5 size	5_10 size	10_50 size	50_100 size	100_250 size	250_500 size	500_plus size	
0	0	0	0	0	0	0	0	0	0
1	10	2	7	33	16	17	11	14	100
2	20	3	11	39	14	21	6	6	100
3	30	3	9	38	18	19	9	3	100
4	40	3	10	41	15	19	6	6	100
5	50	3	10	40	19	18	10	0	100
6	60	3	10	34	17	20	9	7	100
7	70	3	11	43	17	15	7	3	100

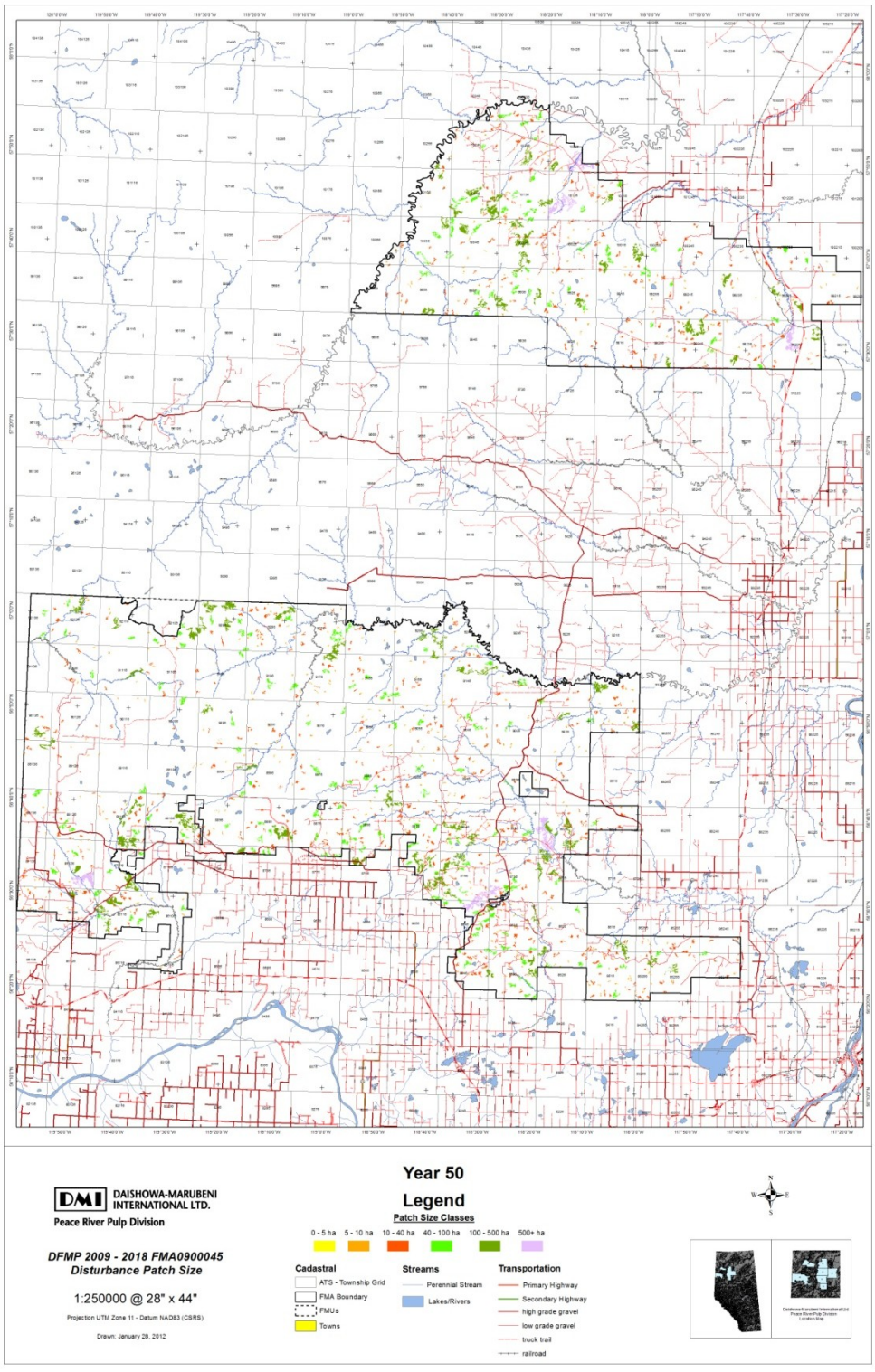
Figure 23. One Period Harvest opening patch size distribution forecast.



Map 9. One Period Harvest Opening Patch Size Distribution Forecast for 2019.



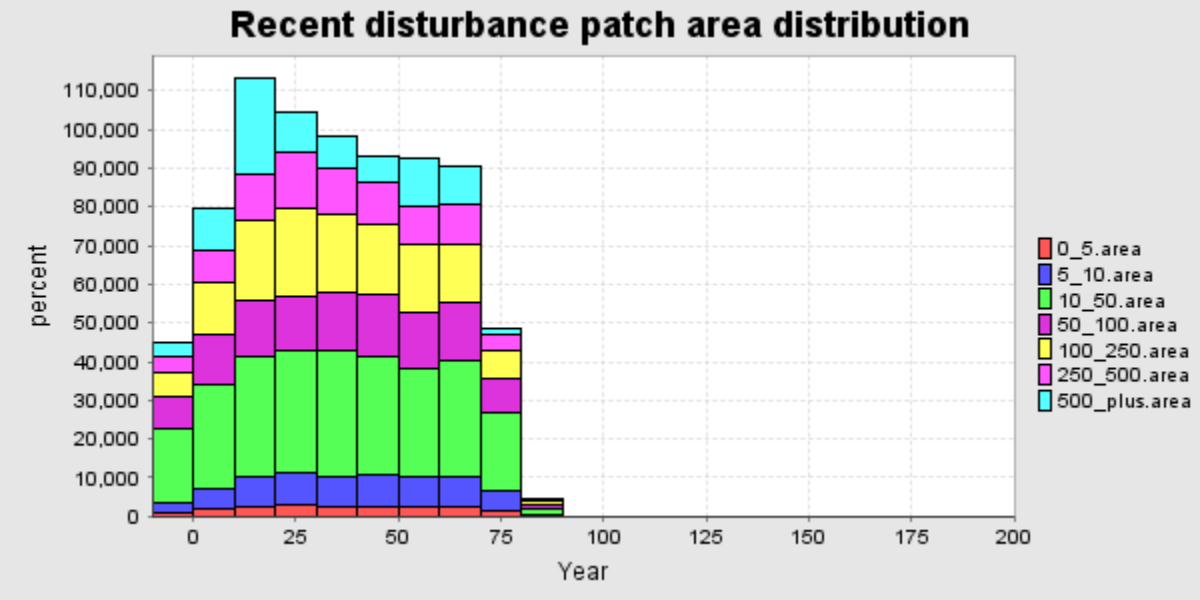
Map 10. One Period Harvest Opening Patch Size Distribution Forecast for 2029.



Map 11. One Period Harvest Opening Patch Size Distribution Forecast for 2059.

6.3.11 Recent Disturbance Patches

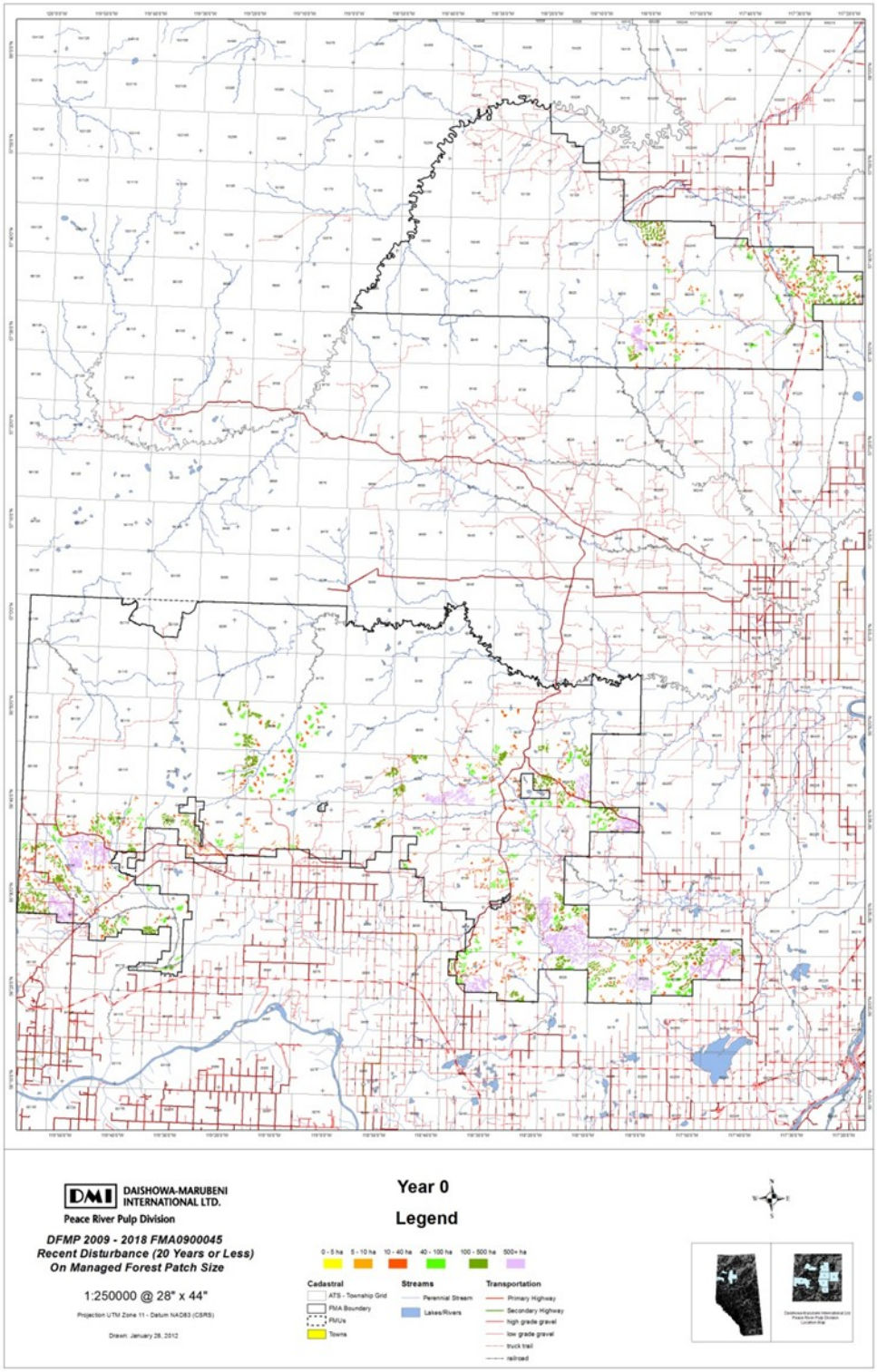
Recent disturbance patches are accumulated contiguous patches of harvested forest less than 20 years old. Area and frequency distributions by patch size were developed using the Patchworks simulation of the 70 harvest sequence.



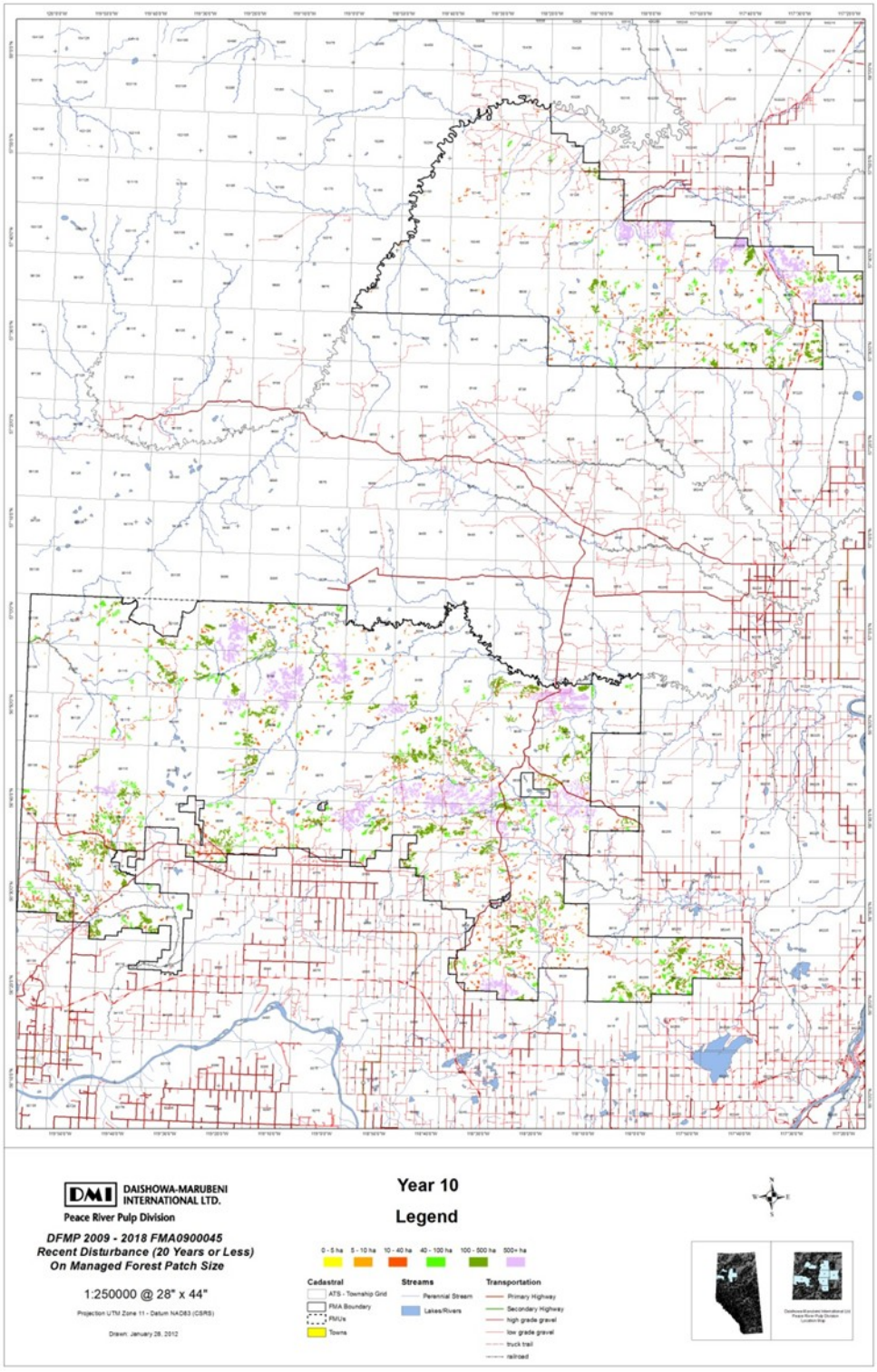
Recent disturbance is defined as the amount of contiguous area less than 20 years old.

Period	Year	patch.disturbance							Total
		0_5	5_10	10_50	50_100	100_250	250_500	500_plus	
		area	area	area	area	area	area	area	
0	0	1,138	2,371	19,414	7,901	6,213	4,221	3,758	45,016
1	10	1,963	5,279	26,748	12,866	13,780	8,252	10,430	79,318
2	20	2,534	7,783	30,963	14,687	20,261	12,040	24,890	113,158
3	30	3,000	8,497	31,471	14,056	22,709	14,271	10,606	104,611
4	40	2,604	7,557	32,455	15,237	20,382	11,790	8,145	98,170
5	50	2,456	8,120	30,726	15,922	18,328	10,750	6,953	93,254
6	60	2,643	7,731	27,728	14,401	17,534	10,090	12,312	92,437
7	70	2,705	7,590	30,193	14,734	15,272	10,018	9,855	90,366

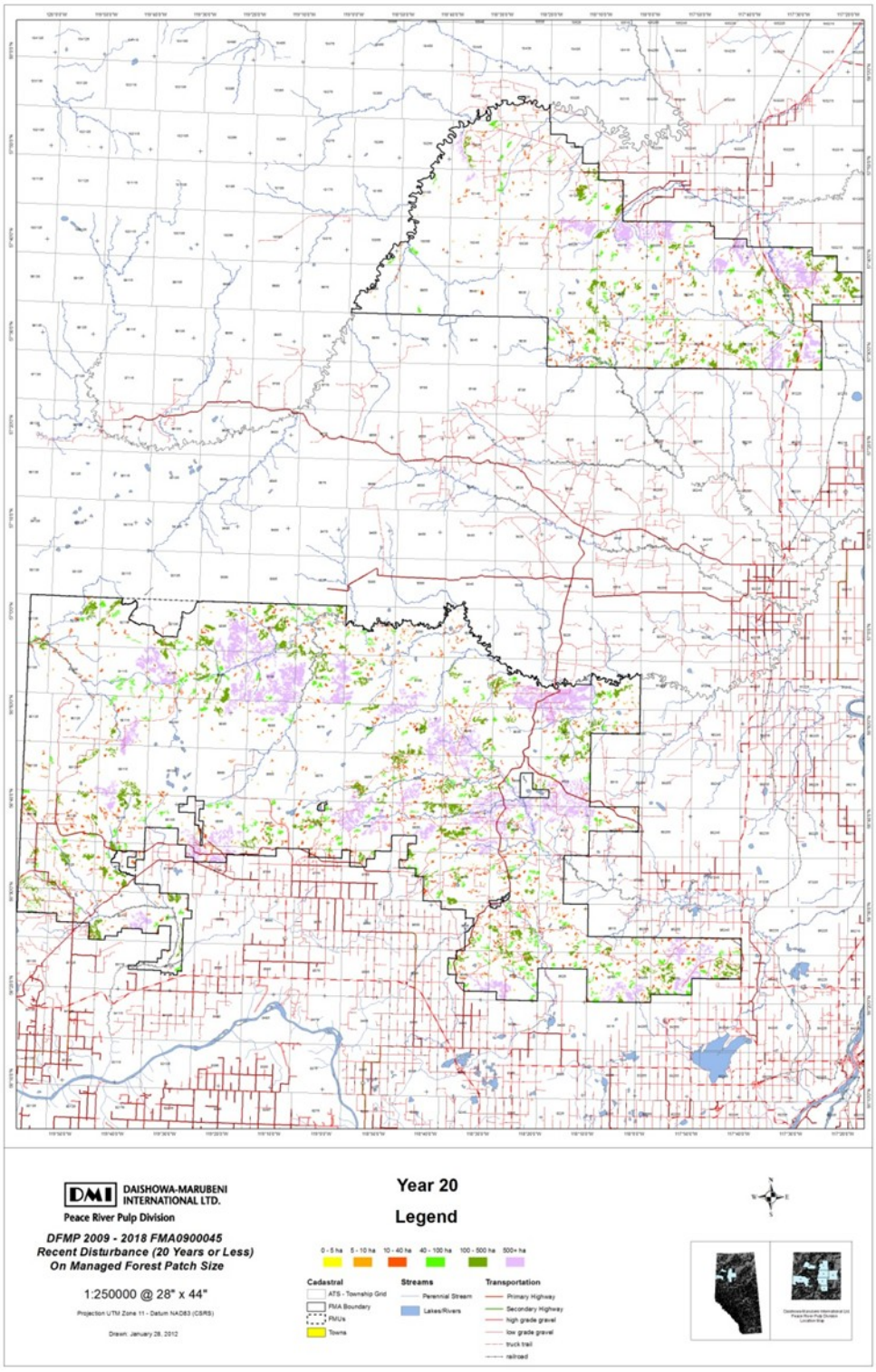
Figure 24. Forecast distribution of recent harvest patches. Harvest blocks less than 20 years old contribute to this metric. The first bar on the left of histogram is the start condition in 2009.



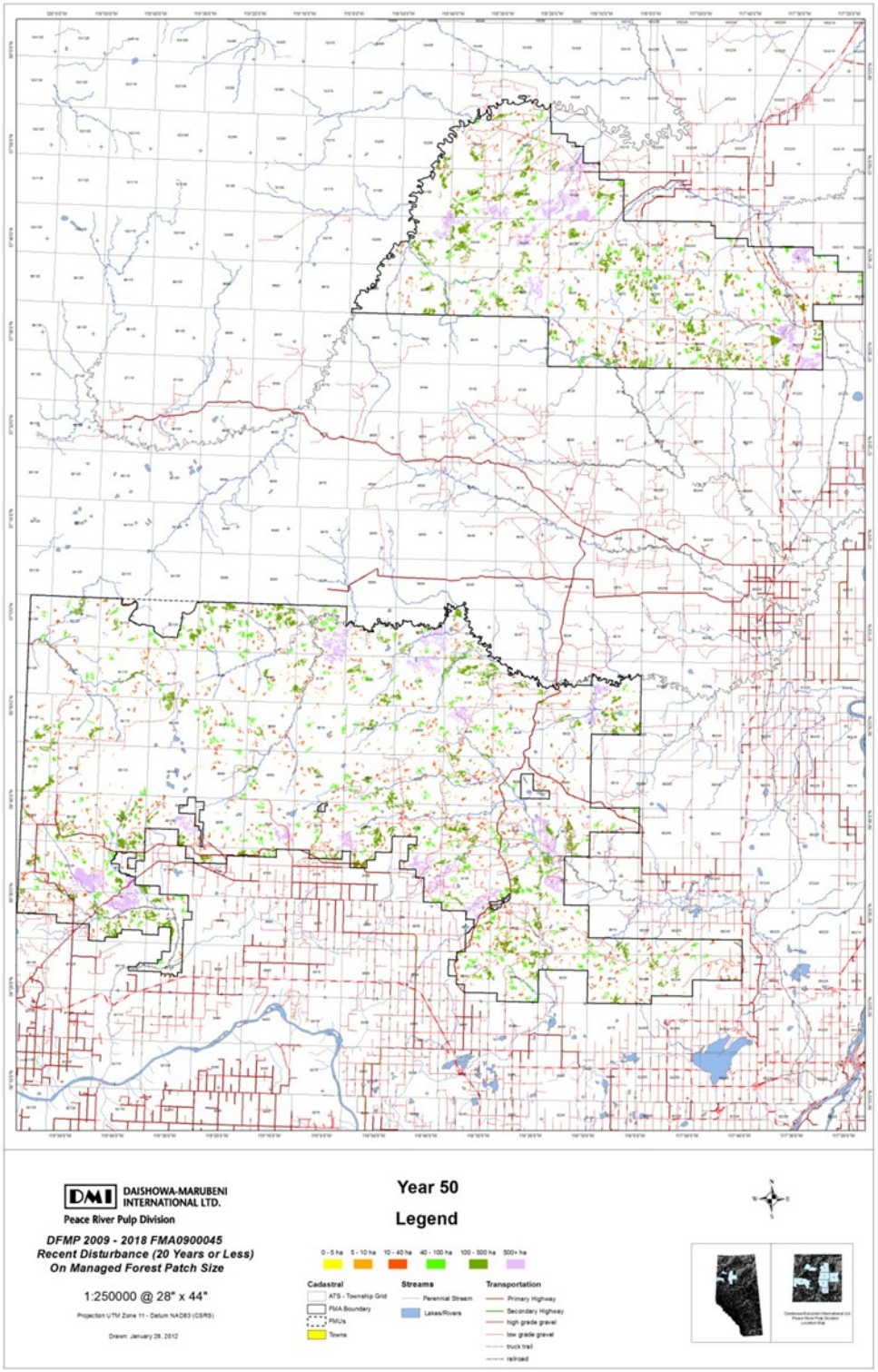
Map 12. Recent Disturbance Patch Condition for 2009. Patches are composed of contiguous net landbase harvested within the past 20 years.



Map 13. Recent Disturbance Patch Condition forecast for 2019. Patches are composed of contiguous net landbase harvested within the past 20 years.



Map 14. Recent Disturbance Patch Condition forecast for 2029. Patches are composed of contiguous net landbase harvested within the past 20 years.



Map 15. Recent Disturbance Patch Condition forecast for 2059. Patches are composed of contiguous net landbase harvested within the past 20 years.

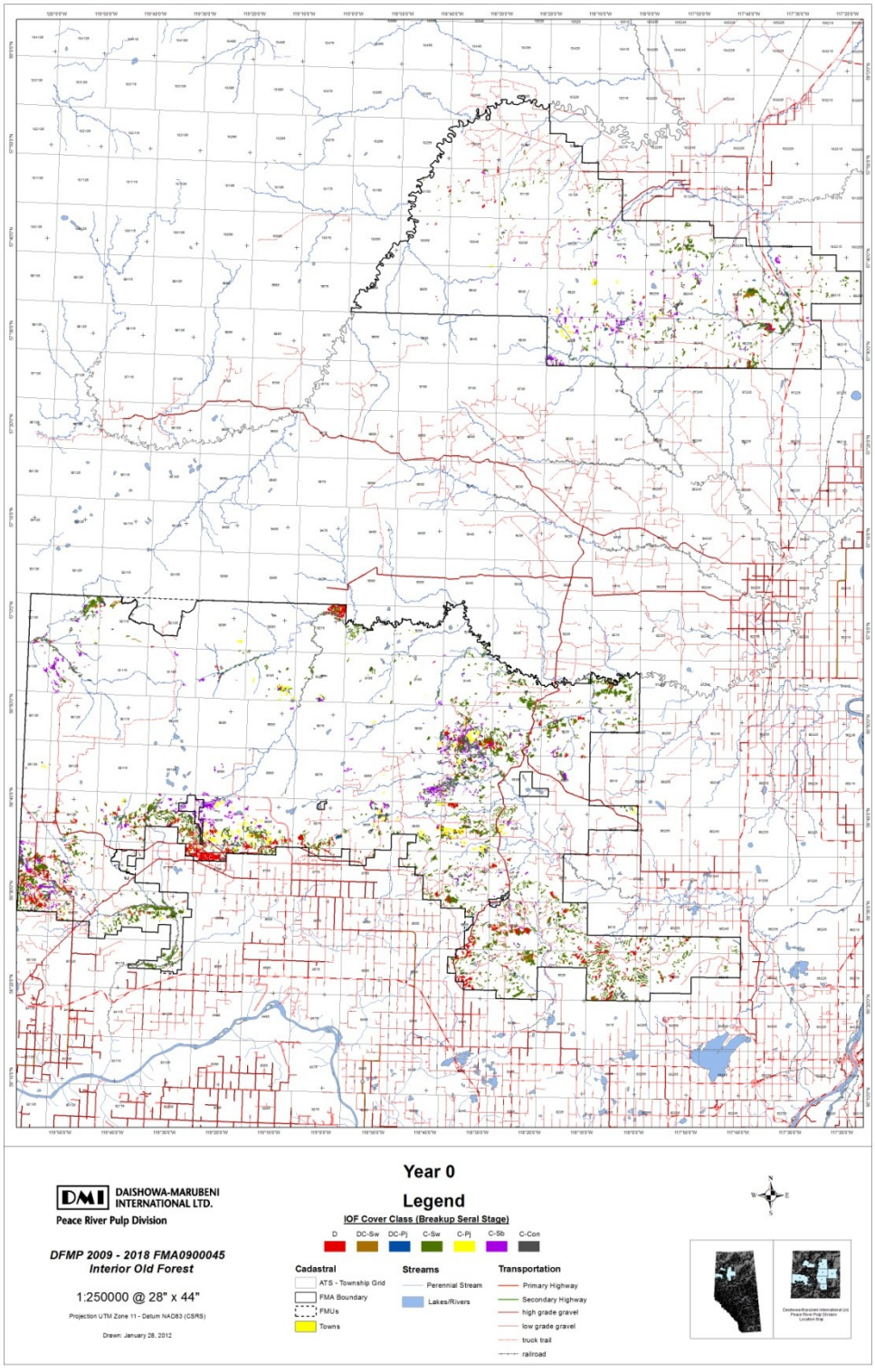
6.3.12 Interior Older Forests

Interior Old Forests (IOF) were analyzed at year 0 (initial), 10 (end of period 2), 20 (end of period 2) and 50 (end of period 5). IOF are defined by the Planning Standard as forested areas greater than 100-ha located beyond any edge-effect buffer zone. These results are derived from the Patchworks analysis discussed in section 3.4.

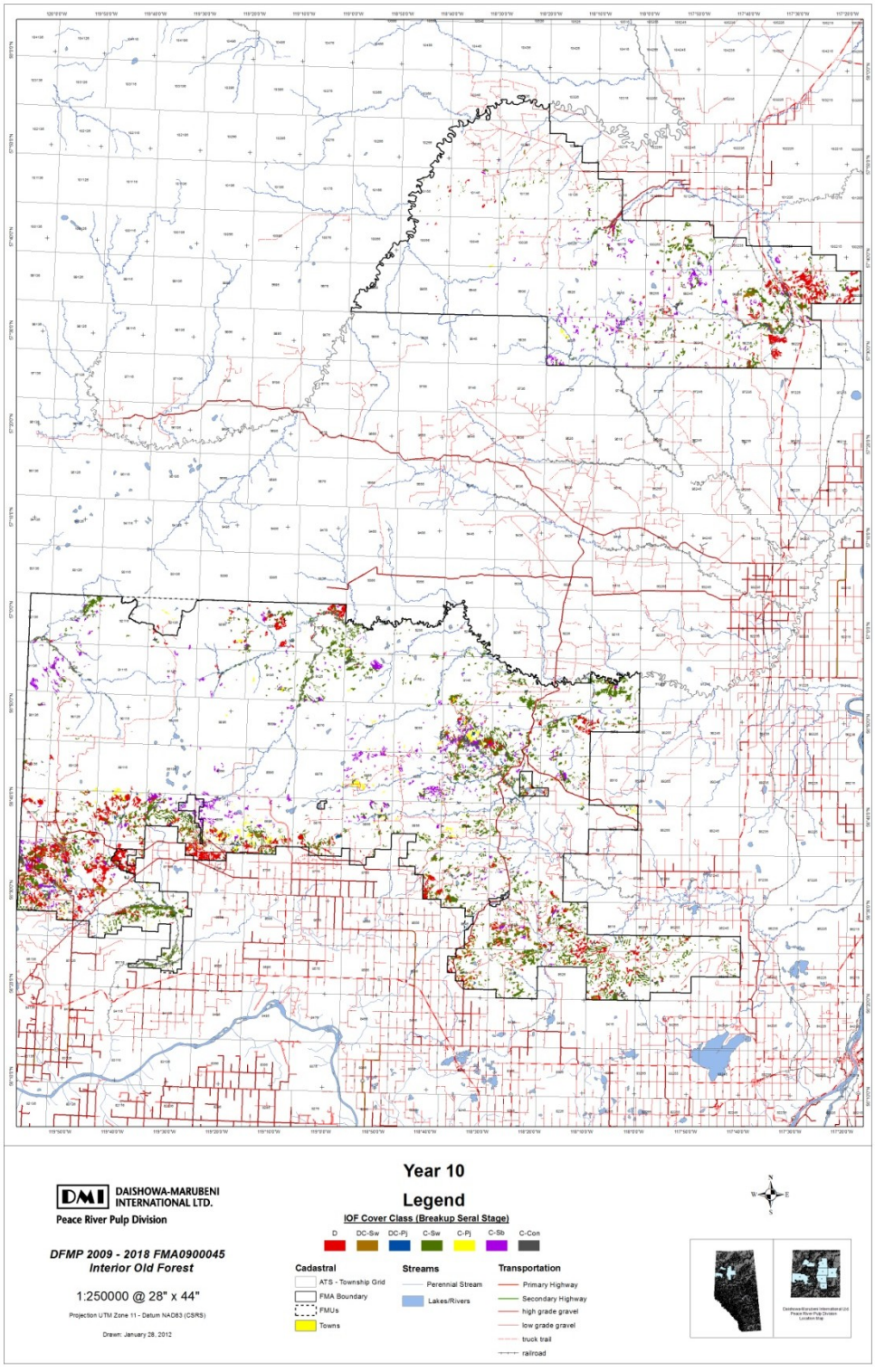
Table 6-7 presents the results of the IOF analysis and indicates an increase in both the total and average IOF area over time. The 'Year 10' values represent the short-term target areas (+/- 10%) for each cover class.

Table 6-7. FMA west interior old forest metrics forecast.

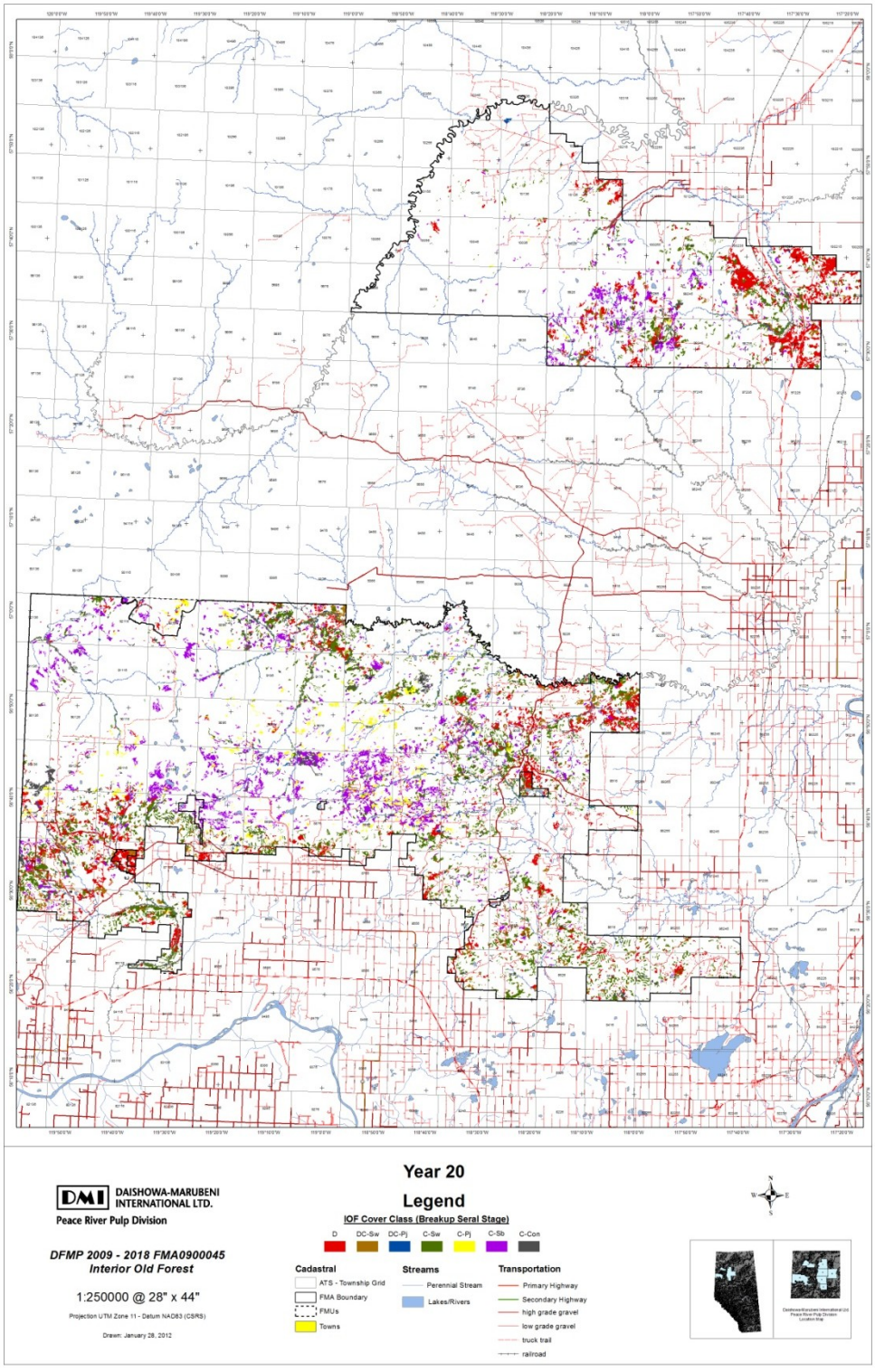
FMA0900045 Interior Old Forest Metrics				
		Year 0 Area Hectares	Year 10 Area Hectares	Year 50 Area Hectares
Cover Class	C_Con	2,391	1,703	5,000
	C_Pj	1,211	703	5,192
	C_Sb	2,397	3,536	44,011
	C_Sw	6,139	9,365	9,899
	D	2,356	6,472	11,114
	DC_Pj	130	258	710
	DC_Sw	1,037	1,847	3,977
SUM		15,661	23,884	79,903
Average Core Size		217 ha	257 ha	541 ha



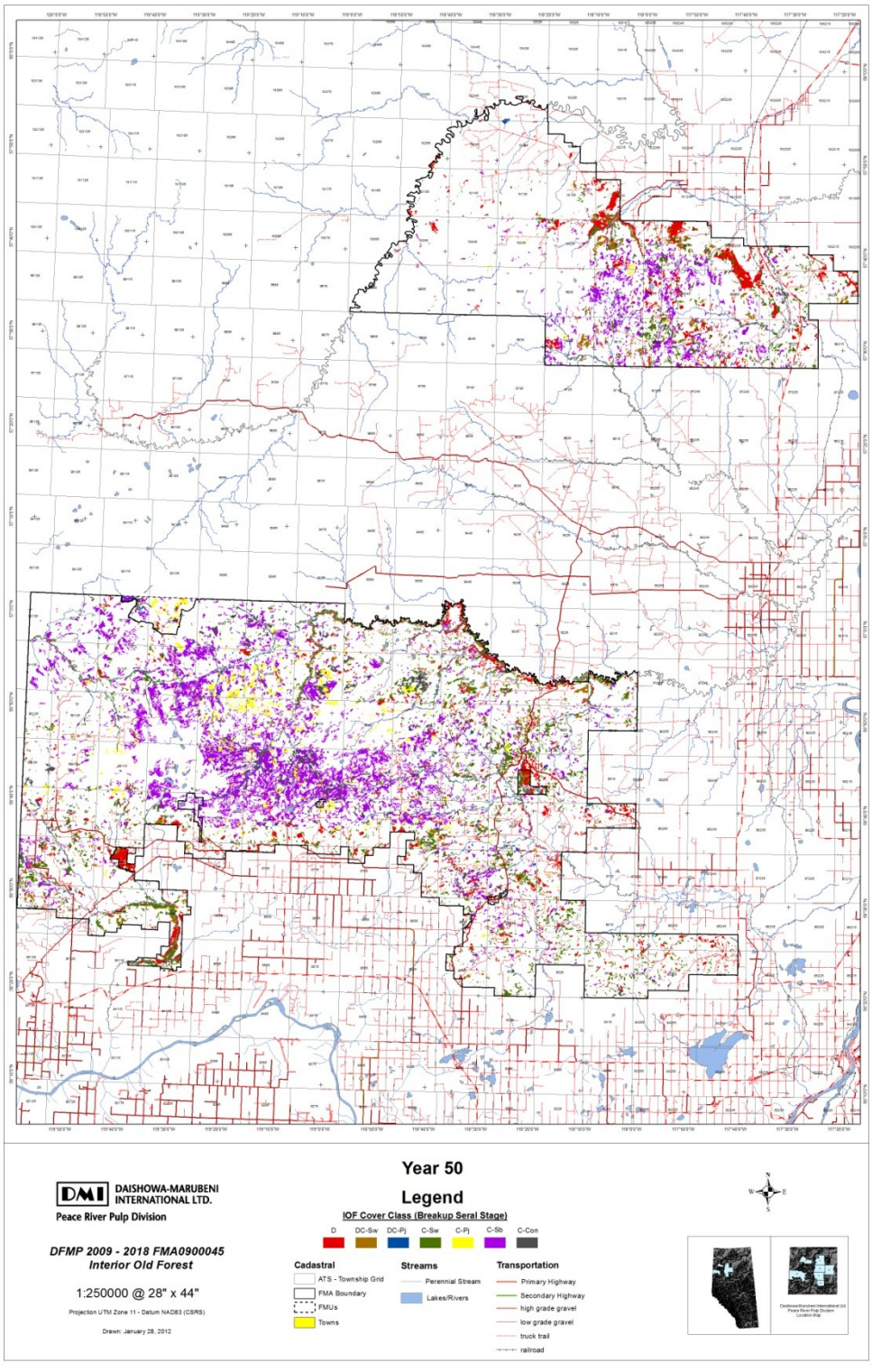
Map 16. Interior Old Forest Forecast in 2009.



Map 17. Interior Old Forest Forecast for 2019.



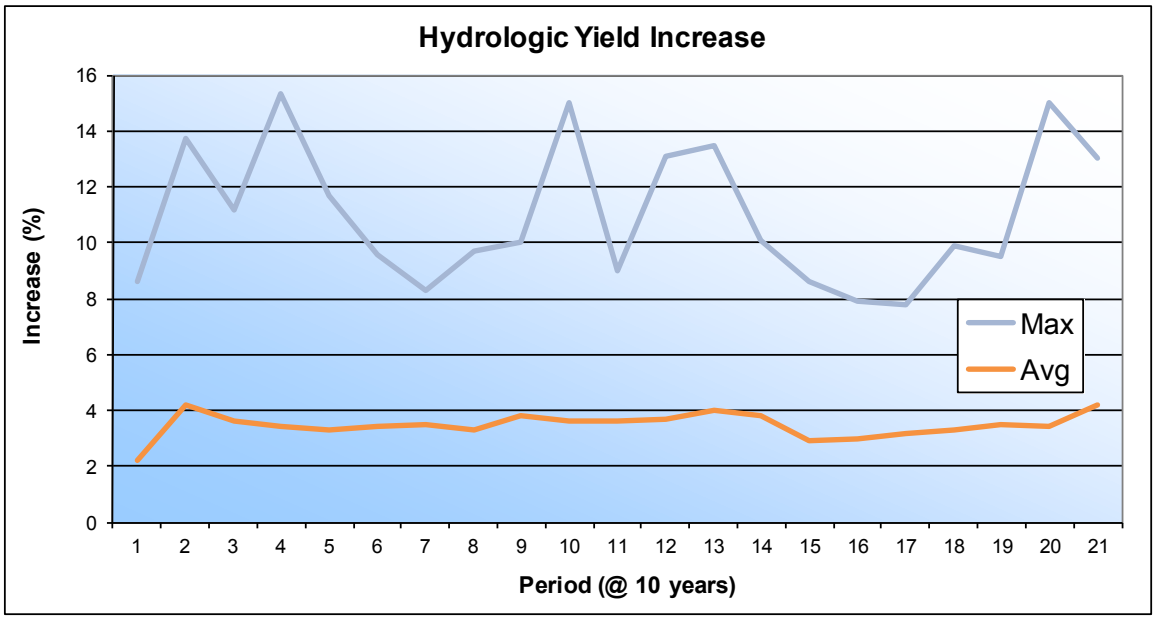
Map 18. Interior Old Forest Forecast for 2029.

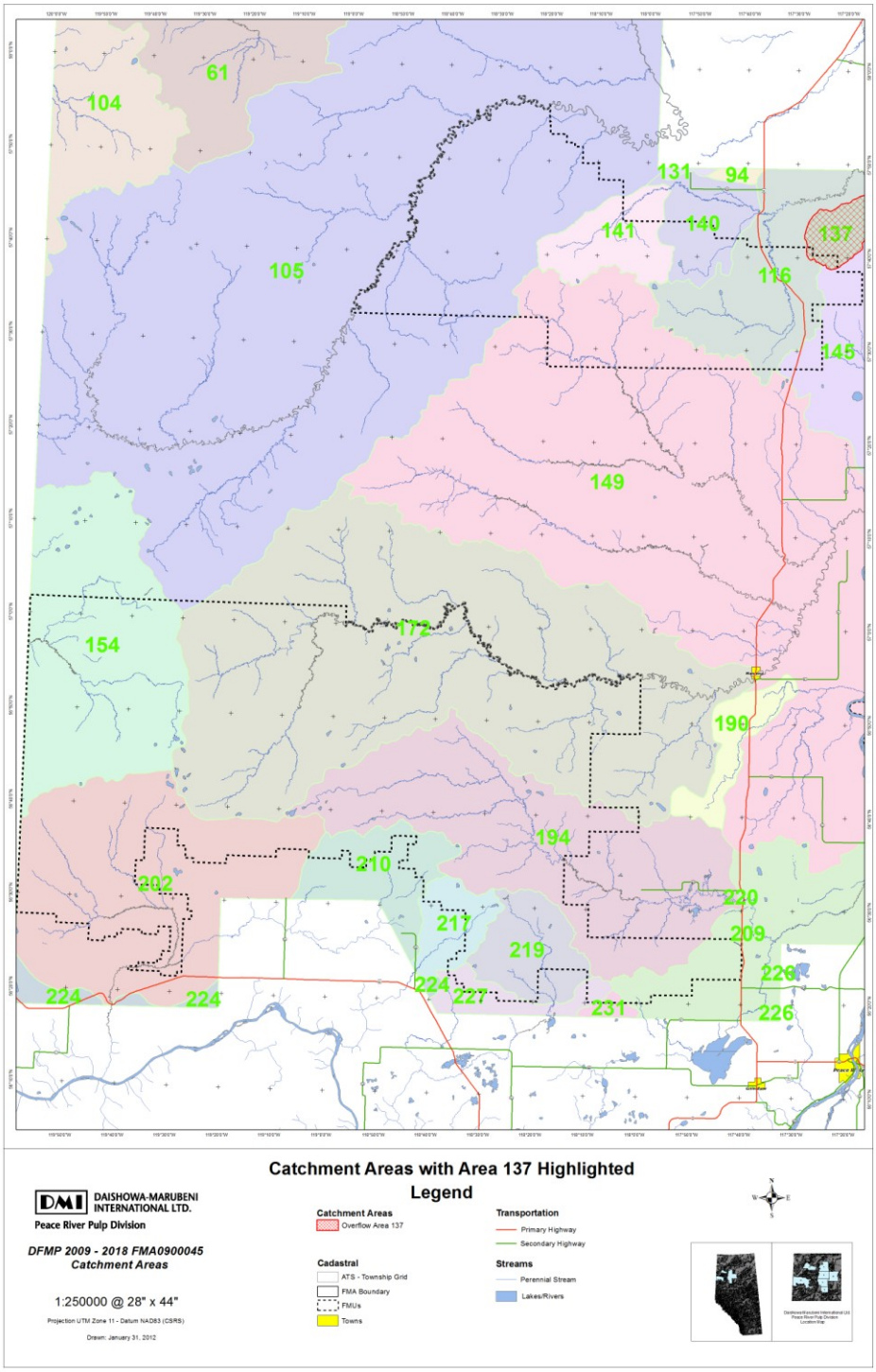


Map 19. Interior Old Forest Forecast for 2059.

6.3.13 Water Yield

The model was constrained to allow no more than 15% hydrologic yield increase in each watershed catchment. The following graph shows the average hydrologic yield increase across P19 and the maximum value across each watershed catchment. The 15% constraint was broken in period 3 with a value of 15.3% in catchment 137 (the second smallest catchment).





Map 20. PRFA watershed catchments used in the ECA calculation for FMA 0900045.

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7 Sensitivity Analysis

Sensitivity analysis involves systematically altering parameters in the timber supply model to examine the effect on harvest levels. There were dozens of systematic aspatial model runs completed during the iterative steps leading to the final scenario. As of the submission date of this document, SRD has not requested specific sensitivity analyses on this final scenario. These will be completed and submitted as an addendum if SRD requests them during the review period.

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8 Comparison to Approved Timber Supply

FMU P19 is a recent amalgamation. The AAC currently applied is a mixture from two previous plans. The lands covered by what was the west portion of FMA8900027 (P10 & P13) were included in the approved 2007 DMI DFMP. The lands covered by the former FMU P1N were included in the P15 TSA. Upon dissolution of P15, the former P1N part was amalgamated into the new P19. The area weighted AAC from the P15 analysis was used to calculate the cuts.

In 2008, ASRD approved the DFMP for P13 & P10 but did not allocate the AAC. Consequently, the AAC for those lands are derived from the 1999 AAC. So, as of today, the AAC for P19 is derived from a 1999 TSA and the P15 TSA.

Table 8-1. Currently applied annual allowable cuts in P19.

Current AAC in P19									
Historical Coniferous Allocations									
	FMU	**Company**	**Dispositon**	**%**	**AAC**	**Sub total**	**%**	**AAC**	**Totals**
	P10	DMI	FMA0900045		20,028		32.8328%	20,028	
VSA 1	P10	Tolko	CTQP100001	67.1672%	40,972	61,000	67.1672%	40,972	**61,000**
	P13	DMI	FMA0900045		38485		13.4427%	38,485	
	P13	Canfor	CTQP130002	69.9700%	162281		56.6843%	162,281	
VSA2	P13	Canfor	CTQP130004	6.3000%	14605		5.1015%	14,605	
	P13	Zavisha	CTQP130005	7.1000%	16469	231,840	5.7526%	16,469	
	P17	Zavisha	CTQP170001	35.7200%	19449		6.7935%	19,449	
	P17	Canfor	CTQP170002	64.2800%	35000	54,449	12.2254%	35,000	**286,289**
								P19 Total	**347,289**
Current Deciduous Allocations									
	FMU	Company	Dispositon	%	AAC				
	P19	DMI	FMA0900045	100	415,682				
* Note: These AACs have had retention removed - retention is not charges against the cut.									

The current TSA incorporates a conifer surge cut in VSA2 during the first 10 year period. This complicates any comparison to past AACs. To try to keep the relative comparison simple, the following explanation of past vs current AAC uses the 200 year average AAC (see *Table 6-1. Forecast Annual Allowable Cuts from Spatial Playback (Nov 24, 2011 Final Run)).* Using the long term average

cuts from the new analysis is consistent with the method used to determine the old cuts – they were derived from long term averages as well.

The proposed AACs to be used on official tenure documents are described in detail in the *Targets & Implementation Document*. The numbers presented in this section are 200 year averages for reference to past productivities only.

The forecast AACs are presented in Table 8-2. These numbers may be adjusted for operational planning of recurring intermittent streams but they serve to illustrate the magnitude of difference between the current allocation and the new. The percent allocations by company are the new proposed percent splits explained fully in the *Targets & Implementations Document*.

Table 8-2. Forecast 200 year average AACs for FMU P19.

Forecast 200 year average AAC for FMU P19					
	Primary Conifer		Secondary Conifer		Total Conifer
Company	Percent of new amalgamated P19	Volume	Percent of new amalgamated P19	Volume	Volume
Tolko	13.02%	54,909	17.80%	29,651	**84,560**
DMI	17.20%	72,549	18.58%	30,955	**103,505**
Canfor	59.67%	251,674	54.40%	90,636	**342,310**
Zavisha	10.11%	42,648	9.22%	15,359	**58,007**
Total Primary Volume		**421,780**	**Total Secondary Volume**	**166,602**	**588,382**
Company	Primary Deciduous		Secondary Deciduous		Total Deciduous
	Percent	Volume	Percent	Volume	Volume
DMI	100%	**494,856**	100%	**141,432**	**636,288**

Table 8-3. Comparison of current P19 AAC allocations to forecast 200 year average AACs.

Comparison of current P19 allocations to forecast 200 year average AACs						
AAC	**Company**	**Current Allocation**	**Forecast 200 year average AAC**	**Difference Volume**	**Difference Volume Adjusted for Retention**	**Difference Percent Adjusted for Retention**
Deciduous	DMI	415,682	636,288	220,606	125,163	30%
Conifer	Tolko	40,972	84,560	43,588	30,904	75%
	DMI	58,513	103,505	44,992	29,466	50%
	Canfor	211,886	342,310	130,424	79,077	37%
	Zavisha	35,918	58,007	22,089	13,388	37%
	Total Conifer	347,289	588,382	241,093	152,835	44%
Total	All Companies	762,971	1,224,670	461,699	277,998	36%

* The current allocations have 15% retention removed. The forecast AACs do not have retention removed. The percent difference has been adjusted 15% to make a fair comparison

Table 8-3 shows that:

- Total AAC is approximately 36% higher than the current allocation.
- Conifer AAC is approximately 44% higher than the current allocation
- Deciduous AAC is approximately 30% higher than the current allocation

8.1 Performance of Last Plan

The current allocations are implemented on the 2007 spatial harvest sequence up to the historic AAC levels. The start-date of the new plan is 2009, thus only 3 years had expired on the 2007 plan. The work for this plan is completely fresh – no attempt was made to compare to the past. The VOITs presented represent forest performance to date and covers the short life span of the 2007 plan.

8.1.1 Pine Beetle

The mountain pine beetle epidemic has dominated conifer harvest and planning for the past 5 years. Harvest sequence, retention strategies and utilization have

all been greatly altered from the past plans. The differences are so great as to make a comparison to the past plan of little use. This new plan accounts for beetle and looks forward, taking its impact into account.

8.2 Significant Events Impacting Planning

8.2.1 Landbase Change

- The landbase has significantly changed. P1N has been added. P13, P11, P1N, and P10 have been amalgamated.
- Large fires from the 1980's have come back into the net landbase
- Grazing dispositions have been removed

8.2.2 Inventory Change

- There is a new AVI inventory for the entire forest.
    - The forest appears to be younger than in previous inventories
        - Forest appears more productive
- P1N previously did not have AVI.
- There are new sample plots and new yield curves values

8.2.3 Strategy Change

The overall management approach is not significantly different from the past but there are changes in the TSA scenario:

- Amalgamated unit for deciduous calculation
- Maximize primary harvests while allowing secondary to float
- Preschedule of 10 years of harvest
- Large conifer pine beetle surge cut
- Old cutblocks stratified onto ARIS declarations rather than onto known trajectories.
- Core/Contingency is implemented
- Watershed ECA constraints added

9 Appendix 1 - Landscape Targets

9.1 Establishing a Target Age Class Distribution

The age class distribution is a key element that would have to be controlled in the future in order to provide for biodiversity and "wildness". The Forestry / Wildlife technical group designed a target age class structure based roughly upon the classic "inverse J" distribution of a theoretical fire-driven natural forest. This structure is shown in Figure 25 as FWITC data. The Management Team modified this input to more closely resemble the "inverse J" distribution by fitting an exponential trend line to the FWITC data. A ratio-reduction was applied to the derived J-curve values to ensure the area in each age class summed to 100%. This adjusted J-curve function was then used to generate modified area targets for each respective age class.

The derived "inverse J" function was applied to the successional and empirical net landbases to calculate the area targets for each age class, landbase and SYU. This work was completed in the Excel spreadsheet "targets2011.xls". The results can be seen in Table 9-4.

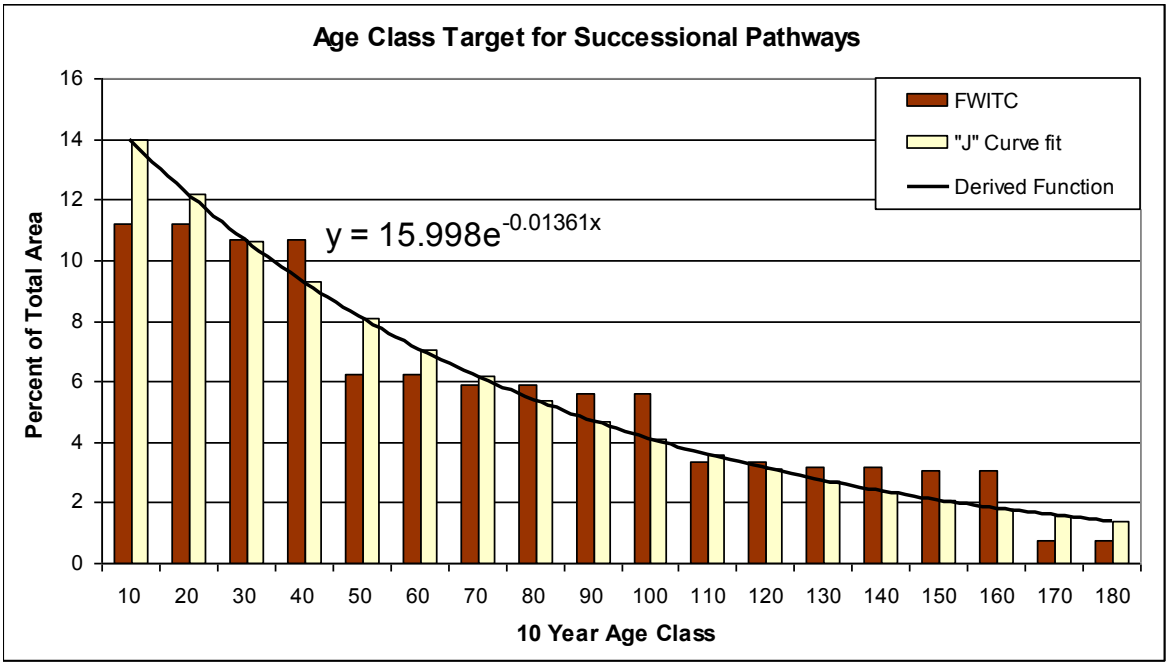


Figure 25. Age Class Targets for Future Forest

Table 9-1 Target Area by Age Class, Landbase and SYU. This is the FWITC ideal age class structure partitioned onto the actual net landbase hectares in each FMA.

			Successional Landbase			Non-Successional Landbase		
			All	West	East	All	West	East
		Net landbase (ha)	1,099,903.00	360,518.00	739,385.00	367,437.00	237,409.00	130,028.00
	Target Distribution		Successional Landbase			Non-Successional Landbase		
Age	FWITC	Derived Function	All	West	East	All	West	East
10	11.2	13.93%	153,177.66	50,207.43	102,970.23	51,171.00	33,062.69	18,108.31
20	11.2	12.15%	133,686.63	43,818.80	89,867.82	44,659.77	28,855.64	15,804.13
30	10.7	10.61%	116,675.72	38,243.10	78,432.62	38,977.05	25,183.92	13,793.13
40	10.7	9.26%	101,829.36	33,376.87	68,452.49	34,017.43	21,979.40	12,038.03
50	6.25	8.08%	88,872.12	29,129.84	59,742.28	29,688.89	19,182.64	10,506.26
60	6.25	7.05%	77,563.62	25,423.22	52,140.39	25,911.14	16,741.75	9,169.39
70	5.9	6.15%	67,694.06	22,188.25	45,505.81	22,614.09	14,611.45	8,002.64
80	5.9	5.37%	59,080.35	19,364.92	39,715.44	19,736.57	12,752.22	6,984.34
90	5.6	4.69%	51,562.69	16,900.84	34,661.86	17,225.19	11,129.57	6,095.62
100	5.6	4.09%	45,001.62	14,750.29	30,251.32	15,033.38	9,713.39	5,319.99
110	3.35	3.57%	39,275.40	12,873.40	26,402.00	13,120.46	8,477.41	4,643.05
120	3.35	3.12%	34,277.82	11,235.33	23,042.49	11,450.95	7,398.71	4,052.24
130	3.2	2.72%	29,916.15	9,805.69	20,110.46	9,993.88	6,457.26	3,536.62
140	3.2	2.37%	26,109.48	8,557.97	17,551.51	8,722.21	5,635.61	3,086.60
150	3.05	2.07%	22,787.19	7,469.01	15,318.17	7,612.36	4,918.51	2,693.85
160	3.05	1.81%	19,887.64	6,518.62	13,369.02	6,643.73	4,292.66	2,351.07
170	0.75	1.58%	17,357.04	5,689.16	11,667.88	5,798.35	3,746.44	2,051.91
180	0.75	1.38%	15,148.45	4,965.25	10,183.21	5,060.54	3,269.72	1,790.82

9.2 Determining the Target Cover Type Distribution

The management plan is founded on the basic premise that forests are dynamic, and that the process of succession determines how change occurs. In the P13 and P10 databases, it is evident that the majority of young stands on the landscape are deciduous, and the majority of old stands are coniferous, consistent with expected findings. This relationship should be carried into the successional age class targets in order to create a future forest that has appropriate amounts of young and old deciduous and conifer.

9.2.1 Calculating Species Composition by Age Class

The data required to calculate the species composition by age class was created using the Microsoft Access accdb file “landscape targets 2011.accdb”. The resultant tables were used in the Excel spreadsheet “targets2011.xls”.

The split between deciduous and coniferous vegetation across the range of ages in the net forested successional landbase is shown for the west FMA in Figure 26

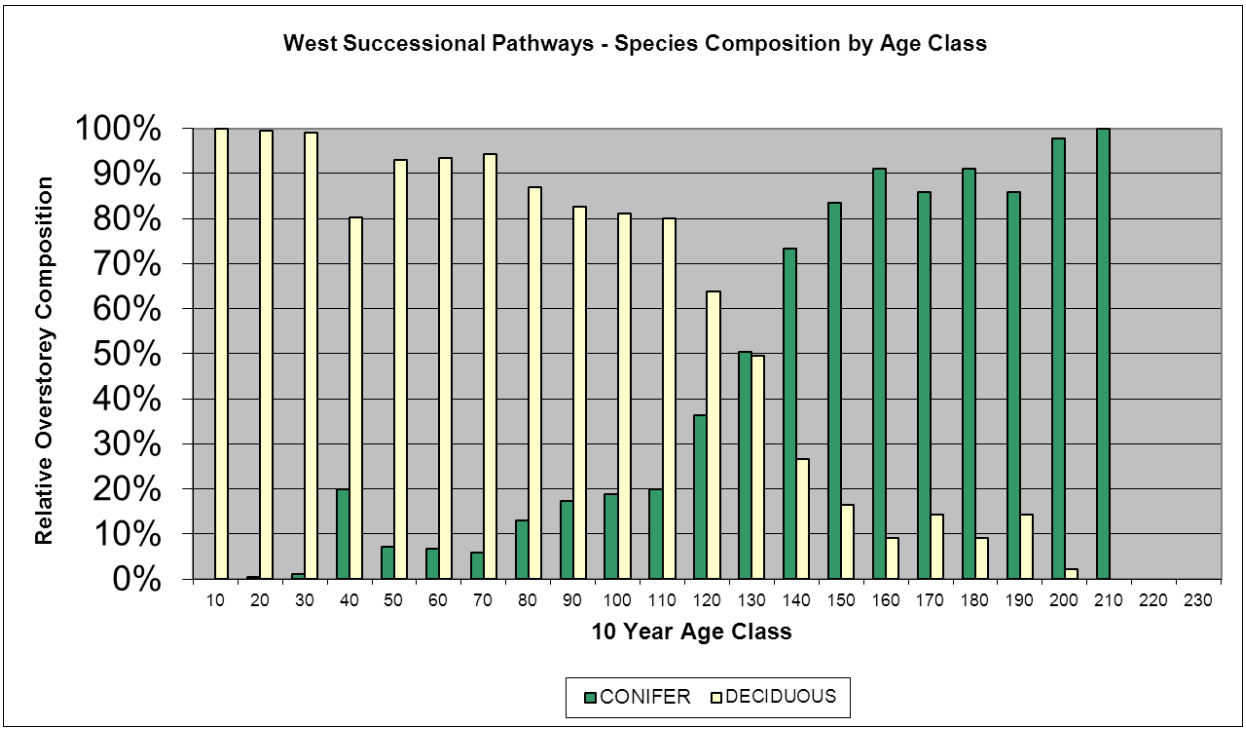


Figure 26. West FMA successional pathways species composition by age class.

The figure shows that a strong relationship exists between cover type and age. Young stands tend to be predominately deciduous (D/DC), while old stands tend to be predominantly coniferous (C/CD). This relationship was used to develop cover type targets for each age class by fitting a 2-order polynomial trend line as shown in Figure 27.

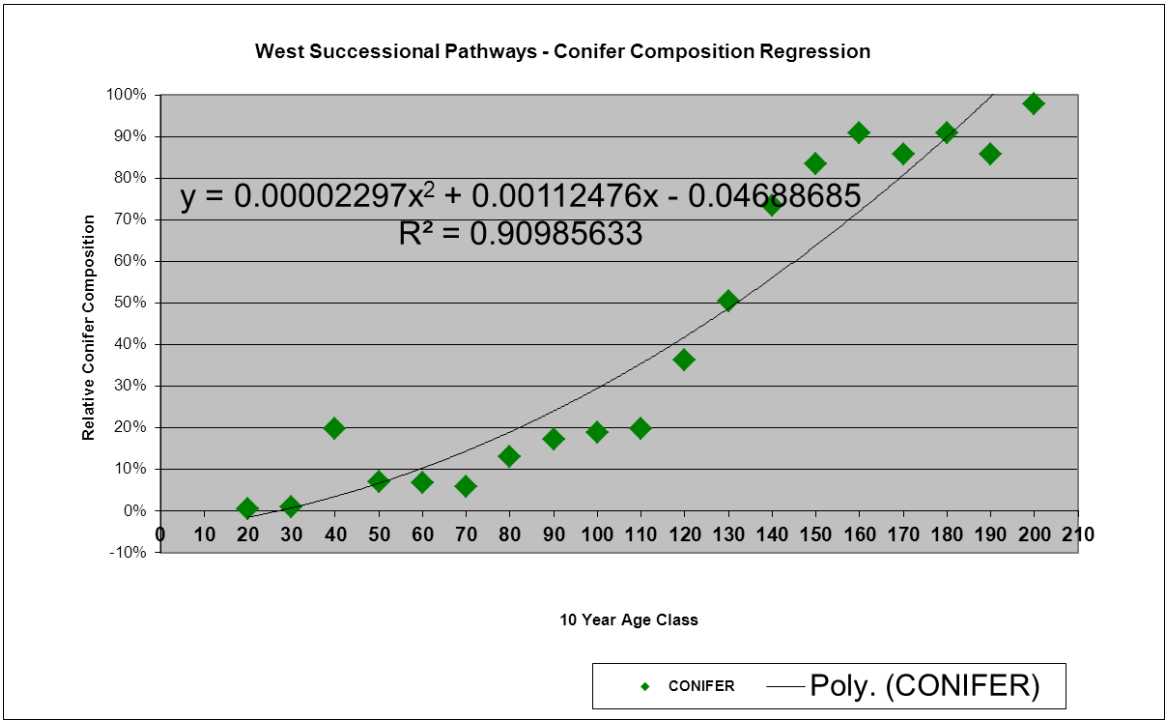


Figure 27. Simple regression representing the percentage conifer dominated area by age class in successional strata on West FMA.

The regression equations were then used to generate cover type composition targets specific to each SYU and age class, as shown in Figure 28.

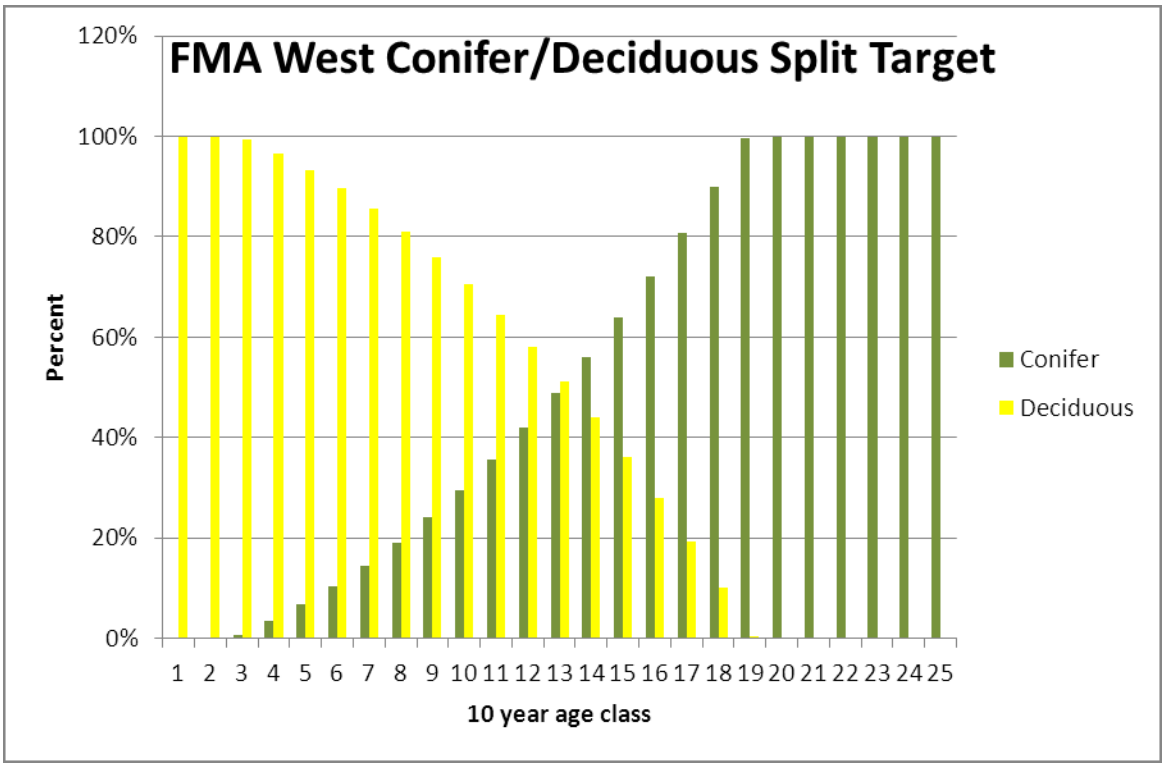


Figure 28. FMA west successional pathways composition target by age class.

The cover type composition targets were then combined with the target areas determined in Section 9.1 to derive target areas for each cover type, by age class, for the successional landbase. These results are shown in Table 9-3. The empirical landbase targets were split by age class only, and not by cover type.

9.2.2 Translating Age Class Targets into Seral Stage Targets

Modeling work has shown that it is not technically possible to achieve individual age class objectives. Given the other variables that needed to be included and the length of the modelling horizon, the model formulation became too large. As a result, the model was simplified to achieve seral stage targets rather than 10-year age class targets. The age class distribution was categorized into ecologically important seral stages. The breakdown of these categories is provided in Table 9-2. On the empirical landbase, the "old" seral stage is made up of all stands of age class 100 and older.

Table 9-2 Seral Stage Classification by Successional Cover Type

Seral Stage	Deciduous age classes	Coniferous age classes
Stem initiation	10	10, 20
Stem exclusion	20, 30	30, 40, 50
Immature	40, 50, 60, 70	60, 70, 80
Mature	80, 90	90, 100, 110, 120
Breakup	100 and older	130 and older

Table 9-3. Calculation of conifer/deciduous split on the target age class structured for successional landbase in FMA West.

				West			
	MATURITY CLASS			CONIFER AREA TARGET		DECIDUOUS AREA TARGET	
AGE	CONIFER	DECIDUOUS	TARGET AREA	RELATIVE	ABSOLUTE	RELATIVE	ABSOLUTE
10	SI	SI	50,207.43	0.00%	0.00	100.00%	50,207.43
20	SI	SE	43,818.80	0.00%	0.00	100.00%	43,818.80
30	SE	SE	38,243.10	0.75%	287.93	99.25%	37,955.17
40	SE	I	33,376.87	3.49%	1,163.37	96.51%	32,213.50
50	SE	I	29,129.84	6.68%	1,945.18	93.32%	27,184.66
60	I	I	25,423.22	10.33%	2,625.98	89.67%	22,797.24
70	I	I	22,188.25	14.44%	3,203.97	85.56%	18,984.28
80	I	M	19,364.92	19.01%	3,681.31	80.99%	15,683.61
90	M	M	16,900.84	24.04%	4,062.94	75.96%	12,837.90
100	M	B	14,750.29	29.53%	4,355.60	70.47%	10,394.69
110	M	B	12,873.40	35.48%	4,567.14	64.52%	8,306.25
120	M	B	11,235.33	41.89%	4,705.94	58.11%	6,529.38
130	B	B	9,805.69	48.75%	4,780.52	51.25%	5,025.17
140	B	B	8,557.97	56.08%	4,799.24	43.92%	3,758.73
150	B	B	7,469.01	63.87%	4,770.10	36.13%	2,698.91
160	B	B	6,518.62	72.11%	4,700.62	27.89%	1,818.00
170	B	B	5,689.16	80.82%	4,597.73	19.18%	1,091.44
180	B	B	4,965.25	89.98%	4,467.72	10.02%	497.53

Initially, targets were set for 20 landscape elements (4 broad cover groups X 5 maturity classes). Even this provided a restrictively complex modelling environment. In model runs it was noted that the younger maturity classes were never limiting, so the final formulation was set to control only 4 elements:

- Conifer dominated mature (C_MAT + CD_MAT)
- Conifer dominated breakup (C_B + CD_B)
- Deciduous dominated mature (D_MAT + DC_MAT)

· Deciduous dominated breakup (D_B + DC_B)

Summing the areas by maturity class within each cover type provided the final seral stage targets, as shown in Table 9-4..

Table 9-4. Model targets for successional landbase in FMA west.

	MATURITY CLASS TARGETS	
MATURITY CLASS	CONIFER	DECIDUOUS
SI	0.00	50,207.43
SE	287.93	81,773.97
I	9,511.26	101,179.68
M	17,691.63	28,521.51
B	28,115.93	40,120.11

Table 9-5. Model targets for empirical landbase in FMA west.

	NON-SUCCESSIONAL		
AGE	All	West	East
10	51,171.00	33,062.69	18,108.31
20	44,659.77	28,855.64	15,804.13
30	38,977.05	25,183.92	13,793.13
40	34,017.43	21,979.40	12,038.03
50	29,688.89	19,182.64	10,506.26
60	25,911.14	16,741.75	9,169.39
70	22,614.09	14,611.45	8,002.64
80	19,736.57	12,752.22	6,984.34
90	17,225.19	11,129.57	6,095.62
100	15,033.38	9,713.39	5,319.99
110	13,120.46	8,477.41	4,643.05
120	11,450.95	7,398.71	4,052.24
130	9,993.88	6,457.26	3,536.62
140	8,722.21	5,635.61	3,086.60
150	7,612.36	4,918.51	2,693.85
160	6,643.73	4,292.66	2,351.07
170	5,798.35	3,746.44	2,051.91
180	5,060.54	3,269.72	1,790.82
Old Target	**83,435.86**	**53,909.72**	**29,526.15**

It was decided that species distribution on the landscape was an important element to control. Again because of complexity, the broad range of species mixtures could only be addressed as deciduous dominated (D+DC) and coniferous dominated (C+CD) stands. While these compromises were necessary for this plan, DMI will continue model development to improve the abilities in the next management plan.

10 Appendix 4 Data Dictionaries

10.1 Flat Tables

The net landbase procedure produces tables of data that are carried forward to the forecasting work. DMI uses the table *out Model_Forest* to bring attributes into the Woodstock and Patchworks models. ASRD prefers the use of flat tables containing all data items used anywhere in the entire DFMP process – The following tables can be used to explain both options.

The stratification processing steps create a table called *temp FlatTable*. The reviewer must run the provided action queries in the net land base forest stratification database to produce this table (the submission is shipped in a 'flattened' data state to save huge amounts of space). As an addendum to this submission, a fully populated version of the flat table is provided. The file *FLAT_table_west* in the MS-Access database *flat_west.accdb* contains the same content as *temp FLAT_TABLE* with some added items to clarify the AVI origin adjustment. All items from *out MODEL_FOREST* are duplicated in both flat tables.

Table 10-1. Flat table data dictionary. The entries in the flat tables may occur in many tables throughout this body of work. The definitions provided in this table apply wherever the item is used.

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**CMPKEY**	Temp MODEL_FOREST – Originates from composite forest creation process	Double	COMPOSITE FOREST KEY : unique identifier of smallest entity in the final composite forest spatial product.	Integer values: P10 (also known as P19 North and VSA1) between 1000001 and 1078655. P19south (also known as VSA2 or P2/P1n/P11/P1) between 3000001 and 3287617 East FMA between 4000001 and 4499352
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**POLYID**	Temp MODEL_FOREST – Originates from AVI VI Oracle process. Definitive source is Stand Poly table	Long	POLYGON ID : UNIQUE IDENTIFIER OF AVI SMALLEST ENTITY RECORD Each TWP-RGE-MER-PID unique combo (formerly called 'forestkey') has a unique polyid	Integer values auto generated by Oracle within VI program.
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**BLOCKS_UK**	Blocks feature class in the input geodatabase Originating item is called "blocks_key".	Double	unique key from 'IN cutover summary' ' (Master update table that pulls all sources of past and future cuts together) Actual cuts up to 2010 season	Integer values. Unique values represent a block fragment. One cutover may contain many fragments.
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**CONTRIBUTE**	Temp MODEL_FOREST Calculated during the net landbase forest stratification.	Long	Calculated field from forest stratification process. Flags polygons as belonging to net landbase or not.	1= in the net landbase 0 = not in the net landbase
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**TREEDAREAHA**	In Composite Forest West or in composite forest east. Definitive source is the composite forest attribute table from the input geodatabase.	Double	Area in Hectares of each composite forest polygon minus any overlapping seismic disturbance (seismic line buffered by 5m). Calculated in the net land base spatial processing steps.	Decimal numbers.
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**AREAHA**	In Composite Forest West or in composite forest east.. Definitive source is the composite forest attribute table from the input geodatabase	Double	Total composite forest polygon AREA IN HECTARES. Shape_Area/10000 from the geodatabase final composite spatial product.	Decimal Numbers
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**TWP**	In OSCOVER	Long	Township from AVI.	Integer values from 80 to 103
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**RGE**	In OSCOVER	Long	Range from AVI	Integer values from 1 to 26
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**MER**	In OSCOVER	Long	Meridian from AVI	Integer value 5 or 6
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**PID**	In OSCOVER	Long	Polygon Identifier: unique to an interpreted polygon within a township,	Integer value between 1 and 9999
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**strBCGRP_C**	In STAND DATA	Text	Character Code for Composite Broad Cover Group. Calculated during AVI processing	NULL – non forested C - Conifer CD – Conifer leading mixedwood DC – Deciduous leading

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
					mixedwood D - Deciduous
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**RIS LBASE**	In STAND DATA	Text	LBASE as calculated by RIS - Composite weighting scheme used Present for future DMI internal use – not used for decisions in this submission	NULL – non forested C - Conifer CD – Conifer leading mixedwood DC – Deciduous leading mixedwood D - Deciduous
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**STRATIFICATION TYPE**	Temp MODEL_FOREST	Text	Type of stratification method used to update cutblocks or fires. Calculated by the forest stratification process. Maintained as an aid in debugging anomalies.	AVI NON-TREED CUT ASSIGNED YC ASSIGNED AGE CUT ASSIGNED YC ASSIGNED AGE - BURN MOD CUT AVI YC ASSIGNED AGE CUT AVI YC AVI AGE DEFAULT AVI POST AVI BURN ref-cc-burn REMOVALS NON MERCH RETENTION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**Assigned Pathway**	Temp MODEL_FOREST	Long	Yield Curve Stratum assigned by the cutover stratification and/or forest stratification processes. This is the final overwrite going into the TSA model.	Integer value from 0 to 13
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**age at inventory**	Temp MODEL_FOREST	Long	Age of the AVI forest polygon on day photo was flown. Calculated from ORIGIN and REFYEAR during forest stratification.	NULL = no origin ie non forested Integer value between 0 and 243.
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**AGE(YEARS)**	Temp MODEL_FOREST	Long	AGE IN YEARS at time zero (May 1, 2009)	NULL = no origin ie non forested Integer value between 0 and 249
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**AGE(5)**	Temp MODEL_FOREST	Long	AGE IN NUMBER OF 5 YEAR PERIODS on May1, 2009	NULL or 0 = no origin ie non forested Integer value between 1 and 50
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**AGE(10)**	Temp MODEL_FOREST	Long	AGE IN NUMBER OF 10 YEAR PERIODS on May1, 2009	NULL = no origin ie non forested Integer value between 1 and 25
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**CUT PERIOD**	In WEST PREBLOCK ; in EAST PREBLOCK	Long	10 year CUT PERIOD FOR MODEL PRESCHEDULE. Not populated for all pre blocks	NULL – not predetermined by operator Integer value between 1 and 4
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**ACTION**	In WEST PREBLOCK; in EAST PREBLOCK	Long	MODELED ACTION BEING PRESCHEDULED. Just a placeholder until forecasting work determines actual Woodstock formulation	0 = not populated 1 = generic harvest flag
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**PREBLOCK**	In WEST PREBLOCK; in EAST PREBLOCK	Text	PREBLOCK FLAG (Y or Null)	Null = do not tell Woodstock to cut this Y = Tell Woodstock to cut this
temp FLATTABLE; Flat_Table_east;	**OPER**	In WEST PREBLOCK; in EAST PREBLOCK	Text	OPERator of the specified pre block	NULL = no operator assigned

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
Flat_Table_West					CFP = CanFor DMI = DMI ZAV = Zavisha Sawmills Tolko = Tolko Zav=Zavisha BUCH= Buchannan BOUCH = Boucher MTU= Alberta Seehta
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**THEME1**	Temp MODEL_FOREST	Text	Theme1 in Woodstock : Yield Curve assigned	0 to 13
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**THEME2**	Temp MODEL_FOREST	Text	Theme2 in Woodstock model: LandBase	LCIN – Contributing Conifer Landbase LCSEN – Contributing conifer landbase on rugged terrain LDIN – Deciduous contributing landbase LDSEN – Contributing Deciduous landbase on rugged terrain LE – EMEND landbase noncontributing landbase OTHER – Noncontributing landbase
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**THEME3**	Temp MODEL_FOREST	Text	Theme3 in Woodstock model : Status	BURN – Recent burn LINEAR – LandUse deletion MAN – Managed (known cutover) NAT – Natural stand OTHER- non-forest RET – Retention patch
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**THEME4**	Temp MODEL_FOREST	Text	Theme4 in Woodstock model : Forest Management Unit by which decisions are to be made in the DFMP	P10 P11 P1N P1S P2 P3 P4 P5 F1 S15
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**THEME5**	Temp MODEL_FOREST	Text	Theme5 in Woodstock model :Mountain Pine Beetle Susceptibility. Placeholder at this time not used.	Zz – placeholder - Item not used
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**THEME6**	Temp MODEL_FOREST	Text	Theme6 in Woodstock Model – Cost Zones	'D' & <integer value from 1 to 75> & 'C' & <integer value from 1 to 75>
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**SD FLAG**	Temp MODEL_FOREST	Long	SUBJECTIVE DELETION FLAG marks whether the stratification process has deleted this poly for a known SD	0 = not a subjective deletion 1= is a subjective deletion
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**MODEL LANDBASE**	Temp MODEL_FOREST Originates in STAND DATA	Text	Landbase category from DMI internal AVI calculations. Used for quick summaries – not used in this submission. (Calculated Landbase from Composite Broad Cover	LC = Conifer Landbase LD= Deciduous Landbase LE=EMEND Landbase NA= NonForested Anthropogenic NN= Natural nonForest

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
				Group)	VA= Vegetated Anthropogenic VN= Vegetated Natural
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**GRAZING FLAG**	Temp MODEL_FOREST	Long	Grazing range flag: Grazing dispositions that do not preclude harvest.	0 – not within Grazing range 1 – within Grazing range
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**BREAKS FLAG**	Temp MODEL_FOREST	Long	SUBJECTIVE DELETION FOR LAND BELOW BREAKS AND STEEP SLOPES)	0= not below breaks 1=is below breaks (out of net landbase) 2=Rugged terrain (in net landbase) 3= Steep as identified by AVI (out of Net landbase)
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**FMA FLAG**	Temp MODEL_FOREST	Long	Inside FMA Flag	0=Outside FMA 1= Inside FMA
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**LAND USE DEL FLAG**	Temp MODEL_FOREST	Long	SEISMIC, PIPELINES,ETC	0 = not a landuse deletion 1= is a landuse deletion
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**WATER_BUFFER FLAG**	Temp MODEL_FOREST	Long	WATER COURSE BUFFERS Flag:	0= not in a buffer 1 = in a buffer
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**deletion1**	Temp MODEL_FOREST	Text	Priority Deletion Type: All deletions are flagged so that all combinations can be identified. This is the priority deletion that 'most' kicks it out of the net landbase. It is used for reporting purposes in the net landbase document. It is calculated in the forest stratification process	BURN LAKE LAND USE LRG_PERM NO HARVEST NO STRAT NONFMA NONFOREST PRIVATE Sb SD SM_PERM STEEP SWAN
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**nonfor**	In STAND DATA Originates in multiple AVI ostory fields	Text	Non Forest Calls: Multiple AVI Ostory fields contain non-forest categories. These are pulled together in one field for internal DMI queries to add efficiencies.	NULL = not a nonfor; must be forested A HF HG IF IG IH II IP IW MB MC MS P SC SO SR WF WL WR
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**RESERV_DEL FLAG**	Temp MODEL_FOREST	Long	Area with timber harvesting restriction	0 = no harvest restriction 1= has a harvest restriction (eg PSP plots, research plots, PNTs)
temp FLATTABLE;	**CALC LBASE**	Temp MODEL_FOREST	Text	Calculated Landbase from	LC = Conifer

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
Flat_Table_east; Flat_Table_West		Originates in STAND DATA – DMI internal use		Composite Broad Cover Group: Applies recent historical landbase designation rules based on FMU and AVI BCGRP. Does not utilize cutover information.	LD= Deciduous XX= Non Contributing
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**FMU**	In OSCOVER	Text	Forest Management Unit from AVI – Old ones used because they still have political and business relevance – they are required for decision making in this DFMP	P10 P11 P1N P1S P2 P3, P4, P5, F1, S15
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**FMU2**	In CUTOVER SUMMARY	Text	Forest Management Unit assigned to cutblocks- Workaround for slivers of blocks that stray over FMU lines and would otherwise cause false reporting.	P10 P11 P1N P1S P2 P3, P4, P5, F1, S15
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**New_FMU**	In COMPOSITE FOREST WEST	Text	Current official Forest Management Unit	P19 FOR West P3, P4, P5, F1, S15 for East
temp FLATTABLE; Flat_Table_West	**VSA**	In COMPOSITE FOREST WEST	Text	Volume Supply Area label for west fma volume supply areas	VSA1 = P10 (or P19 North) VSA2 = P1&P2&P11 (or P19 south)
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**CATCHKEY**	In COMPOSITE FOREST WEST	Text	CATCHMENT KEY: IDENTIFIER OF WATERSHED: Also the foreign key to link into the input geodatabase. These are the PFRA gauged watersheds aligned with the HYDAT data.	105 116 137 140 141 145 149 154 172 194 202 209 210 217 219 227 231
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**PATHWAY1**	Temp MODEL_FOREST Originates in VI_STRATA	Long	PATHWAY ASSIGNED IN 2011 YIELD CURVE METHODOLOGY : Default yield curve stratification based on AVI attributes before any overrides from newer update information. 'Yield Curve assigned on day of AVI photo using only AVI information'	Integer value from 0 to 13
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**PATHLABEL**	Temp MODEL_FOREST Originates in VI_STRATA	Text	TEXT LABEL DESCRIBING THE PATHWAY ASSIGNED IN 2011 YIELD CURVE METHODOLOGY	PATHLABEL Aspen>>EarlyMixed>>WhiteSpruce Aspen>>LateMixed>>WhiteSpruce Aspen>>Shrub Aspen>>WhiteSpruce AspenMixed>>WhiteSpruce BalsamPoplar>>Shrub

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
					BlackSpruce BlackSpruce-Pine/Whitespruce Deciduous-Pine-BlackSpruce NFC Pine Pine-BlackSpruce-Deciduous Pine-WhiteSpruce Wspruce>>WhiteSpruce
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**compflag**	In STAND DATA	Text	Flags the status of the composite BCGRP weighting scheme. Explains where the stand data record comes from.	C= Composite of overstory and understory calls using the weighting scheme O= Uses the overstory calls only to determine BCGRP U= uses the Understory only to determine the BCGRP
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**intBCGRP**	In STAND DATA	Long	Integer Code for overstory Broad Cover Group	-1= non forested Integer values represent Deciduous Content 0= 0% 1=10% 2=20% 3=30% 4=40 5=50% 6=60% 7=70% 8=80% 9=90% 10=100%
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**strBCGRP**	In STAND DATA	Text	Character Code for overstory Broad Cover Group	NULL – non forested C - Conifer CD – Conifer leading mixedwood DC – Deciduous leading mixedwood D - Deciduous
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**intBCGRP_C**	In STAND DATA	Long	Integer Code for Composite Broad Cover Group	-1= non forested Integer values represent Deciduous Content 0= 0% 1=10% 2=20% 3=30% 4=40 5=50% 6=60% 7=70% 8=80% 9=90% 10=100%
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**LEADSP**	In STAND DATA	Text	Leading species – single most prevalent species	NULL Aw Bw Fb Lt Pb Pl Sb

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
					Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**HEIGHT**	In STAND DATA	Long	Height in 1 m classes	-1 = nonforest Integer Values from 0 to 34
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**HT6M**	In STAND DATA	Integer	Height in 6 m classes – carry over from Phase3 methods.	-1=nonforest Integer values from 0 to 6
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**DENSITY**	In STAND DATA	Text	AVI Density Class A,B,C,D	NULL = nonforest A B C D
temp FLATTABLE;	**in STAND DATA_ORIGIN**	In STAND DATA	Long	10 year origin class from the adjusted or 2010 calculation	Integer decade classes: 0 1770 to 2000
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**TPR**	In STAND DATA	Text	Overstory Timber Productivity Rating assigned by photo interpreter. – This is the one used in yields and net landbase.	Null= not a productive forest type U=unproductive forest F=fair M=medium G=good
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**OS_LBASE**	In STAND DATA	Text	Overstory Landbase based on AVI ostory only	LC LD XX
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**US_LBASE**	In STAND DATA	Text	Understory Landbase based on understory only	LC LD XX
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**CALC LBASE_O**	In STAND DATA	Text	Calculated Landbase from overstory Broad Cover Group	LC LD XX
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**CALC LBASE2**	In STAND DATA	Text	Calculated Landbase from Composite Broad Cover Group	LC LD XX
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**in STAND DATA_DELETION**	In STAND DATA	Text	Deletion Type – Blank not used	Blank not used
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**NONFOREST**	In STAND DATA	Text	Non Forest Calls: Multiple AVI Ostory fields contain non-forest categories. These are pulled together in one field for internal DMI queries to add efficiencies	NULL = not a nonfor; must be forested A HF HG IF IG IH II IP IW MB MC MS P SC SO SR WF WL WR
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**species group**		Text	Species Group: major species categories used for exploratory work	species group AW AW-FB AW-LT

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
					AW-P AW-SB AW-SW BW BW-FB BW-LT BW-P BW-SB BW-SW FB FB-AW FB-BW FB-PB LT LT-AW LT-BW LT-PB non-treed P P-AW PB PB-FB PB-LT PB-P PB-SB PB-SW P-BW P-PB SB SB-AW SB-BW SB-PB SW SW-AW SW-BW SW-PB
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**PATHWAY**	In VI STRATA	Double	PATHWAY ASSIGNED IN 2011 YIELD CURVE METHODOLOGY: Default yield curve stratification based on AVI attributes before any overrides from newer update information. 'Yield Curve assigned on day of AVI photo using only AVI information'	Integer value from 0 to 13
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**LABEL**	In VI STRATA	Text	TEXT LABEL DESCRIBING THE PATHWAY ASSIGNED IN 2011 YIELD CURVE METHODOLOGY	PATHLABEL Aspen>>EarlyMixed>>WhiteSpruce Aspen>>LateMixed>>WhiteSpruce Aspen>>Shrub Aspen>>WhiteSpruce AspenMixed>>WhiteSpruce BalsamPoplar>>Shrub BlackSpruce BlackSpruce-Pine/Whitespruce Deciduous-Pine-BlackSpruce NFC Pine Pine-BlackSpruce-

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
					Deciduous Pine-WhiteSpruce Wspruce>>WhiteSpruce
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**REFAGE**	In VI STRATA	Double	reference age (ie age on date photo was flown) used for regression in yc development	Integer values
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**PATHWAY_AGE**	In VI STRATA	Integer	age used in regression - (last full 10 years period fully achieved) eg 47 years old = currently in period 5 = age 40	Integer values
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**MOISTURE_OSCOVER**	In OSCOVER	Text	Moisture Regime 'd' , 'a', 'w', 'm' (from table: in OSCOVER)	d a w m
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**CC_OSCOVER**	In OSCOVER	Text	Overstorey Crown Closure - 25% classes A, B, C, D	A B C D
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**HEIGHT_OSCOVER**	In OSCOVER	Long	1metre height class	Integer values 0 to 34
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**S1**	In OSCOVER	Text	Species 1(from table: in OSCOVER)	null Aw Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**P1**	In OSCOVER	Long	Percentage Crown Closure of Species 1 - 10% classes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**S2**	In OSCOVER	Text	Species 2	null Aw Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**P2**	In OSCOVER	Long	Percentage Crown Closure of Species 2 - 10% classes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**S3**	In OSCOVER	Text	Species 3	null Aw Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**P3**	In OSCOVER	Long	Percentage Crown Closure of Species 3 - 10% classes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**S4**	In OSCOVER	Text	Species 4	null Aw Bw Fb Lt

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
					Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**P4**	In OSCOVER	Long	Percentage Crown Closure of Species 4 - 10% classes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**S5**	In OSCOVER	Text	Species 5	null Aw Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**P5**	In OSCOVER	Long	Percentage Crown Closure of Species 5 - 10% classes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**STRUCTURE**	In OSCOVER	Text	Stand Structure Flag - M=multistory	M=multistory
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**in OSCOVER_ORIGIN**	In OSCOVER	Long	10 year Origin class: 2010 adjusted origin	Integer decade values
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**TPR_OSCOVER**	In OSCOVER	Text	Timber Productivity Rating Uses AVI interpreters' assigned TPR	Null U F M G
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**INTERTPR**	In OSCOVER	Text	Interpreted TPR Flag from AVI. If the value is 1, then the interpreter has overridden the calculated method	Null = the AVI published calculation methodology is used 1 or I= the AVI photo interpreter over-rode the calculation and assigned the TPR.
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**NONFORTYPE**	In OSCOVER	Text	Non-Forest Type - AVI	NULL = doesn't have a non forest type HF=forbs HG= grasses SC= closed shrub SO=open shrub
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**NONFORCL**	In OSCOVER	Long	Non-Forest Shrub Closure - 10% Crown Closure Classes for SO & SC Nonfortypes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**ANTHVEG**	In OSCOVER	Text	Anthropogenic Vegetated -	NULL A=Annual Crops; P=Perrennial Crops; IP=Industrial Pipeline; IW=Wellsite; IU= Unknown Clearing A
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**in OSCOVER_ANTHNONVEG**	In OSCOVER	Text	Anthropogenic Non	NULL= not an anthropogenic non veg type IF= Industrial Farm IG= Industrial Gravel IH = Industrial HIghways II= Industrial Plant sites

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
					SR = Ribbon Development
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**NATNONVEG**	In OSCOVER	Text	Natural Non-Vegetated -	NULL= not a naturally non-vegetated site MB= Burn Recent MC= Cutbank MS=Sand WF= Flooded WL=Lakes WR=Rivers
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**intBCGRP_OSCOVER**	In OSCOVER	Long	Integer Broad Cover Group : 10% Crown Closure Class of Deciduous Species	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**strBCGRP_OSCOVER**	In OSCOVER	Text	String Broad Cover Group - C, CD, DC, D	NULL – non forested C - Conifer CD – Conifer leading mixedwood DC – Deciduous leading mixedwood D - Deciduous
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**compflag_OSCOVER**	In OSCOVER	Text	Composite Flag - used in composite weighting scheme	O = use overstory C= use composite U = use understory
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**species group_OSCOVER**	In OSCOVER	Text	A Coarse Level classification of leading species	AW AW-FB AW-LT AW-P AW-SB AW-SW BW BW-FB BW-LT BW-P BW-SB BW-SW FB FB-AW FB-BW FB-PB LT LT-AW LT-BW LT-PB non-treed P P-AW PB PB-FB PB-P PB-SB PB-SW P-BW P-PB SB SB-AW SB-BW SB-PB SW SW-AW SW-BW SW-PB

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**REFYEAR**	In OSCOVER	Long	Reference Year: Year in which AVI photo was flown	Integer year value: 1997 2003 2004 2006
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**MOISTURE_U**	In USCOVER	Text	Moisture Regime 'd' , 'a', 'w', 'm' (from table: in USCOVER)	A=aquatic D=dry W=wet M=mesic
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**CC_U**	In USCOVER	Text	Understorey Crown Closure - 25% classes A, B, C, D	Null A B C D
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**HEIGHT_U**	In USCOVER	Long	1metre height class	
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**S1_U**	In USCOVER	Text	Species 1	null Aw Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**P1_U**	In USCOVER	Long	Percentage Crown Closure of Species 1 - 10% classes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**S2_U**	In USCOVER	Text	Species 2	null Aw Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**P2_U**	In USCOVER	Long	Percentage Crown Closure of Species 2 - 10% classes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**S3_U**	In USCOVER	Text	Species 3	null Aw Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**P3_U**	In USCOVER	Long	Percentage Crown Closure of Species 3 - 10% classes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**S4_U**	In USCOVER	Text	Species 4	null Aw Bw Fb Lt Pb Pl Sb Sw

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**P4_U**	In USCOVER	Long	Percentage Crown Closure of Species 4 - 10% classes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**S5_U**	In USCOVER	Text	Species 5	null Aw Bw Fb Lt Pb Pl Sb Sw
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**P5_U**	In USCOVER	Long	Percentage Crown Closure of Species 5 - 10% classes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**STRUCTURE_U**	In USCOVER	Text	Stand Structure Flag - M=multistory	NULL M
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**ORIGIN_U**	In USCOVER	Long	10 year Origin class assigned by AVI interpreter	Integer values decades
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**TPR_U**	In USCOVER	Text	Timber Productivity Rating assigned by AVI interpreter	U F M G
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**NONFORTYPE_U**	In USCOVER	Text	Non-Forest Type - BR, HF, HG, SC, SO	NULL HF HG SC SO
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**NONFORCL_U**	In USCOVER	Long	Non-Forest Shrub Closure - 10% Crown Closure Classes for SO & SC Nonfortypes	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**ANTHVEG_U**	In USCOVER	Text	Anthropogenic Vegetated - A=Annual Crops; P=Perrennial Crops; IP=Industrial Pipeline; IW=Wellsite; IU= Unknown Clearing	NULL A=Annual Crops; P=Perrennial Crops; IP=Industrial Pipeline; IW=Wellsite; IU= Unknown Clearing A
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**in USCOVER_ANTH NONVEG**	In USCOVER	Text	Anthropogenic Non Vegetated -IF, IG, IH, II, IW, SA, SR	NULL IF IG IH II SR
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**NATNONVEG_U**	In USCOVER	Text	Natural Non-Vegetated - MB, MC, MR, MS, WF, WL, WR	NULL MB MC MS WF WL WR
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**intBCGRP_U**	In USCOVER	Long	Integer Broad Cover Group : 10% Crown Closure Class of Deciduous Species	Integer values 0 to 10
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**strBCGRP_U**	In USCOVER	Text	String Broad Cover Group - C, CD, DC, D	NULL – non forested C - Conifer CD – Conifer leading mixedwood DC – Deciduous leading mixedwood

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
					D - Deciduous
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**NONFOREST_U**	In USCOVER	Text	NonForest Class - Concatenation of NONFORTYPE, ANTHVEG, ANTHNONVEG, NATNONVEG	NULL BR HG SC SO
temp FLATTABLE;	**species group_U**	In USCOVER	Text	A Coarse Level classification of leading species	AW AW-FB AW-LT AW-P AW-SB AW-SW BW BW-FB BW-LT BW-P BW-SB BW-SW FB FB-AW FB-BW FB-PB LT LT-AW LT-BW LT-PB non-treed P P-AW PB PB-FB PB-P PB-SB PB-SW P-BW P-PB SB SB-AW SB-BW SB-PB SW SW-AW SW-BW SW-PB
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**BLK_DET_ID**	In CUTOVER SUMMARY Originates in BLK Details Table	Double	Unique identifier assigned to each record in the Blocks Details table (from table: in CUTOVER SUMMARY)	Integer values 1 to 23587
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**OPEN_NUM**	In CUTOVER SUMMARY	Text	ARIS Opening number	Alphanumeric code
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**DISPBLK**	In CUTOVER SUMMARY	Text	Disposition Block:Concatenation of disposition and block number	Disposition-Block#
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**STOCK_STAT**	In CUTOVER SUMMARY	Text	Stocking Status:	NULL CSR= conditional FTG=Free to Grow NSR=not sufficiently stocked PSC=??? SR= sufficiently stocked
temp FLATTABLE;	**BLK_CLASS**	In CUTOVER SUMMARY	Text	BLOCK CLASS from BLOCKS	CUT = harvested portion

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
Flat_Table_east; Flat_Table_West		Originates in Blocks feature class		feature class: CUT - harvested portion of block; RET- Retention; REM- Removals(only GPSd polys)	REM=removal RET= Retention
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**BLK_SOURCE**	In CUTOVER SUMMARY	Text	SOURCE from BLOCKS feature class : Where did the spatial data come from? Codes are names of DMI internal data sources	AVI_1 AVI_2 Built GOV GPS LAYOUT ORTHO PHOTO PLAN UPD
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**BLK_TYPE**	In CUTOVER SUMMARY	Text	BLOCK TYPE: from BLOCKS feature class: Type of block component	FA= Flood GR= Grass I=Internal (applies to retention) LU= LandUse SH=Shrubs UN=UnMerchantable US=UnderStory Protection X= External (applies to retention) TS= Tree Size DE=Density HT=Height TP=Topography
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**BLK_TYPE_STAT**	In CUTOVER SUMMARY	Text	BLOCK TYPE STATUS from BLOCK feature class:Source of retention/removal data:	P= Planned U= Unplanned
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**OP_AREA**	In CUTOVER SUMMARY	Text	Operating Area = Cut disposition: License/compartment numbers, MOF flag	Harvest disposition before 2008. DMI operating area after 2008 253 unique values
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**BLOCK_ID**	In CUTOVER SUMMARY	Text	Number assigned to block when harvested, if known. Only Unique within a license within a timber year	Alphanumeric code
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**ARIS_FMU**	In CUTOVER SUMMARY	Text	ARIS FMU alphanumeric codes:	P010 P01D P020 P02D P100 P10D P110 P130 P140 P150 P190 P520 P530
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**DISP_TYPE**	In CUTOVER SUMMARY	Text	Disposition Type: Type of disposition such as CTP, CTL, FMA, MOF, LTP. EMEND, FMA,	CTL CTP DTL DTP FMA LTP MOF

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**SKID_DATE**	In CUTOVER SUMMARY	Date/Time	Date that timber was skid-cleared	Date 1053 unique entries
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**SKID_YEAR**	In CUTOVER SUMMARY	Double	The 4-digit timber-year that harvesting occurred in. Timber years start May1 and End April 30.	Integer year value SKID_YEAR 1980 1981 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**SURV_TYPE**	In CUTOVER SUMMARY	Text	Survey type conducted (Establishment or Performance): Est Survey; Per Survey	EST SURVEY PER SURVEY NULL
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**LBASE_CODE**	In CUTOVER SUMMARY	Text	Landbase code as per ARIS Industry Operations Manual, Appendix C - Domain Codes	LBASE_CODE CC CD DD DH DM FP HD HH SC SS
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**REGEN_CODE**	In CUTOVER SUMMARY	Text	Regeneration code as per ARIS Industry Operations Manual, Appendix C - Domain Codes	 C-2000 CD-2000 CONF D-2000 DC-2000
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**CON_VOL**	In CUTOVER SUMMARY	Long	Conifer Harvest Volume if known – not used	
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**DEC_VOL**	In CUTOVER SUMMARY	Long	Deciduous Harvest Volume if known – not used	
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**SOURCE_BLK_NUM**	In CUTOVER SUMMARY	Text	Source Block Number: Block Numbers provided by source - not always valid but used at	

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
				times to manually sort out mis-matched records when building BLK Details Table	
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**CUTB_SEQ_NBR**	In CUTOVER SUMMARY	Long	Cut Block Sequence Number: Source Provided Block 'number' alphanumeric code	1371 unique codes
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**HARV_STAT**	In CUTOVER SUMMARY	Text	Harvest status- Has it been cut?	Null CUT
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**BLK_STATUS**	In CUTOVER SUMMARY	Text	BLOCK STATUS from BLOCKS feature class: CUT- block cut and photo confirmed, PLANNED - block laid out with GPS, FUTURE - future block, RET_INT - retention internal to block, RET_EXT - retention external to block (from table: in CUTOVER SUMMARY)	NULL – not used anymore
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**HARV_YEAR**	In CUTOVER SUMMARY	Long	HARVEST YEAR: DMI manual assignment of harvest year from many sources from BLOCKS feature class	Integer year values
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**RETREAT**	In CUTOVER SUMMARY	Text	ARIS flag for NSR CSR stands requiring retreatments	NULL RTD
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**OP_REF_RES**	In CUTOVER SUMMARY	Text	OPERATOR with REFORESTATION RESPONSIBILITIES	NULL= unknown BCHE= Buchannan CBVA=CBVAC CFPL= Canfor DAIS= DMI ZAVI= Zavisha
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**TOT_STOCK**	In CUTOVER SUMMARY	Long	ARIS Total Stocking Percentage	Integer value from 0 to 100
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**cPOST91**	In CUTOVER SUMMARY	Long	CALCULATED POST91 FLAG: Is this record Post 91? Yes or No	0=not a post91 block 1= this is a post91 block
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**cPRE91**	In CUTOVER SUMMARY	Long	PRE91 block? : 1 = yes, 0 = no	0= not a Pre91 block 1 = it is a Pre91 block
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**cPOST08**	In CUTOVER SUMMARY	Long	POST 2008 block?: 1 = yes, 0 = no These are flagged because they are viewed as pre-scheduled in the TSA	0= not a Post08 block 1 = it is a Post08 block
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**cARIS_LINK**	In CUTOVER SUMMARY	Long	CALCULATED ARIS LINK: Does this record have an ARIS Record? Yes or No	0=no link to ARIS 1= Has a ARIS opening number
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**cCUT_TYPE**	In CUTOVER SUMMARY	Long	CALCULATED CUT TYPE: 1 - 8	NULL – not used anymore
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**cARIS_AGE FLAG**	In CUTOVER SUMMARY	Long	CALCULATED ARIS AGE FLAG: Does this record have an ARIS skid timber year? 1= yes; 0 = no	0 = no link to an ARIS skid timber year 1 = has an ARIS skid timber year
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**cHARVEST YEAR FLAG**	In CUTOVER SUMMARY	Long	CALCULATED HARVEST YEAR: DMI manual assignment of harvest year from many sources: 1 = yes; 0 = no	0=no assignment 1= used the harv_year for aging

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**cAVI AGE FLAG**	In CUTOVER SUMMARY	Long	CALCULATED AVI AGE FLAG: Use AVI origin. 1 = yes; 0= no	0 = did not flag to use AVI for aging 1 = did use avi for aging
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**cAVI Strat FLAG**	In CUTOVER SUMMARY	Long	CALCULATED AVI STRATIFICATION FLAG: 1 = yes; 0=no	0 = did not use AVI for stratification of yield curve 1= did use AVI to assign yield curve
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**in CUTOVER SUMMARY_ASSIGNED YC**	In CUTOVER SUMMARY	Long	ASSIGNED PATHWAY: G&Y 2011 valid pathways	Integer value from 1 to 12 assigned if a yield curve decision was made during the cutover summary processing
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**ASSIGNED AGE(YEARS)**	In CUTOVER SUMMARY	Long	ASSIGNED AGE: Age(years) assigned by stratification routine	Integer year value assigned if an age decision was made during the cutover summary processing
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**ASSIGNED TREATMENT**	In CUTOVER SUMMARY	Long	Assigned Treatment: For prescheduled blocks in Woodstock model. Harvest treatment code	0= no treatment assigned 1= generic place holder assigned meaning harvest
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**ASSIGNED TREATMENT YEAR**	In CUTOVER SUMMARY	Long	Assigned Treatment year: For prescheduled blocks in Woodstock Model. Future harvest year if known. Forces the model to 'catch up' to known harvests that have occurred since May1 2009.	0 2009 2010
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**ASSIGNED LBASE**	In CUTOVER SUMMARY	Text	Assigned Lbase based on strata declaration and FMU	NULL: not assigned LC: conifer lbase LD: deciduous lbase NA: non forest anthropogenic NN: non forest natural VN: vegetated non-forest
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**REGEN CODE**	In DECLARED STRATA	Text	Declared Stratum C, CD, DC, D (from table: in DECLARED STRATA)	C-2000 CD-2000 CONIFER D-2000 DC-2000 PR91 XX
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**in DECLARED STRATA_ASSIGNED YC**	In DECLARED STRATA	Long	G&Y2011 PATHWAY (from table: in DECLARED STRATA)	-1 = NON FOREST 0 = NON PRODUCTIVE 1 = DECIDUOUS 3= DC 4= CD 6 = CONIFER
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**BLOCKS_KEY**	IN COMPOSITE FOREST WEST Originates in Blocks feature class	Double	Unique identifier of record from blocks input feature class (from table:temp COMPOSITE FOREST)	Integer value
temp FLATTABLE;	**VI1_POLYID**	IN COMPOSITE FOREST WEST Originates in Blocks feature class	Double	Unique polygon ID - Link into old Vegetation Inventory (AVI1) attributes (only within cutblocks) Before disallowed by ASRD, this was used to stratify cuts by using knowledge of what was cut.	Integer value
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**GRAZING_KEY**	IN COMPOSITE FOREST WEST	Double	Unique identifier of record from Grazing input feature class	Integer value

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**PARK_KEY**	IN COMPOSITE FOREST WEST	Double	Unique identifier of record from Parks input feature class	Integer value
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**FMA**	IN COMPOSITE FOREST WEST	Double	FMA flag: 0 - not within the FMA, 1 - within the FMA	0 = not in FMA 1 = inside fma
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**COMPARTMENT**	IN COMPOSITE FOREST WEST	Text	DMI Compartment name/number	NOT POPULATED IN THIS SUBMISSION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**TRAPNO**	IN COMPOSITE FOREST WEST	Text	Trap line number (provincial unique identifier)	NOT POPULATED IN THIS SUBMISSION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**ZONENUM**	IN COMPOSITE FOREST WEST	Text	Number assigned to each compartment (cost zone). Only unique within one sustainable yield unit	NOT POPULATED IN THIS SUBMISSION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**ZONENAME**	IN COMPOSITE FOREST WEST	Text	Name assigned to each compartment (cost zone). If no name assigned, the name corresponds to the zone number.	NOT POPULATED IN THIS SUBMISSION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**CARIBOU**	IN COMPOSITE FOREST WEST	Double	Caribou range flag	0 = Not inside ASRD supplied boundary of Nov 2010 1 = Inside ASRD supplied boundary of Nov 2010
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**TEARDROP**	IN COMPOSITE FOREST WEST	Double	Lubicon traditional area flag as follows:	Not applicable on west fma
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**FMADEL**	IN COMPOSITE FOREST WEST	Text	Appendix "A" deletions as follows:	0 or null = not a deletion 1 = FMA deletion
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**IRTAG**	IN COMPOSITE FOREST WEST	Text	Native Reserves within the Appendix A deletions as follows:	0 or null = not an Indian Reserve deletion 1 = it is an Indian Reserve Deletion
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**GRAZING**	IN COMPOSITE FOREST WEST	Double	Grazing range flag: (No harvest restriction on this type)	0 – not within Grazing range 1 – within Grazing range
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**BREAK**	IN COMPOSITE FOREST WEST	Double	Area of topographic concern as follows:	1 – area within incised valleys 2 – area of rugged terrain 3 – area too steep to operate
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**hydrobuf**	IN COMPOSITE FOREST WEST	Text	Flag of area buffered around each hydrographic type	LAKE LRG_PERM SM_PERM SWAN
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**FIRENUM**	IN COMPOSITE FOREST WEST	Text	Unique name assigned to each fire, "typically" of the form AAA-BBB-YYYY (eg. PWF-042-2002) where:	Alphanumeric code AAA is the LFS Area Identifier BBB is the 3-digit fire sequence num in the LFS Area YYYY is the 4-digit year it occurred. (sometimes 2-digit)
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**FIREYEAR**	IN COMPOSITE FOREST WEST	Double	The 4-digit year during which the fire occurred.	Integer year value 0 2003 2004

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
					2005 2006 2007 2008 2009
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**LU FLAG**	IN COMPOSITE FOREST WEST	Long	Binary flag indicating other disturbances, mainly due to oil-and-gas activity	0 = not a land use deletion 1 = this is a land use deletion
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**MOOSE**	IN COMPOSITE FOREST WEST	Double	Moose range flag as follows:	0 = not within moose zone 1 = within river valley zone 2 = within upland zone
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**NATURAL**	IN COMPOSITE FOREST WEST	Text	Natural sub-regions:	CMW DMW LBH UBH
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**WAM**	IN COMPOSITE FOREST WEST	Text	Wet Area Mapping based on the depth of the water table: 1 - 0.00 to 0.10m, 2 - 0.10 to 0.25m, 3 - 0.25 to 0.50m, 4 - 0.50 to 1.00m	NOT POPULATED IN THIS SUBMISSION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**RESERVATION**	IN COMPOSITE FOREST WEST	Text	Area with timber harvesting restriction	EMEND MWMA NIVMA PNT050181 PSP1990 PSP2005 PSPGOV REC840008 REC890026 REC950006 TSP1999 TSP2005 WESBOGY
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**MPB_SR**	IN COMPOSITE FOREST WEST	Text	Mountain Pine Beetle Susceptibility Rating	NOT POPULATED IN THIS SUBMISSION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**FIRENUMBER**	IN COMPOSITE FOREST WEST	Text	Firenumber from input feature class fires	NOT POPULATED IN THIS SUBMISSION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**LUCLASS**	IN COMPOSITE FOREST WEST	Text	land use class value	Highway Industrial Major Road Minor Road Pipeline Railroad Road Utility Wellsite
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**CRN**	IN COMPOSITE FOREST WEST	Double	Continuous reserve network value	NOT POPULATED IN THIS SUBMISSION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**Shape_LengTH**	IN COMPOSITE FOREST WEST	Double	Shapefile autogenerated polygon perimeter in metres	Decimal number
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**SHAPE_Area**	IN COMPOSITE FOREST WEST	Double	Shapefile autogenerated polygon area in metres squared	Decimal number
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**COST2D_DEC**	HAUL_COSTS	Text	$2 CYCLE HAUL COST TO DMI	Integer value

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**COST2D_CON**	HAUL_COSTS	Text	$2 CYCLE HAUL TO APPROPRIATE SAWMILL (HIGH LEVEL IN vsa1; HINES CREEK IN vsa2)	Integer value Not populated on East FMA
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**BLK_UPD_NON_RET_AREA_HA**	BLK_DETAILS	Double	Area of cut portions (non-retention) of blocks in ha	Decimal number
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**DECD_COND_STOCK**	In CUTOVER SUMMARY	Double	Deciduous conditional stocking from ARIS	Decimal number between 0 an 100
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**DECD_ACC_STOCK**	In CUTOVER SUMMARY	Double	Deciduous acceptable stocking from ARIS	Decimal number between 0 an 100
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**CONF_COND_STOCK**	In CUTOVER SUMMARY	Double	Conifer conditional stocking from ARIS	Decimal number between 0 an 100
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**CONF_ACC_STOCK**	In CUTOVER SUMMARY	Double	Conifer acceptable stocking from ARIS	Decimal number between 0 an 100
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**ORIGINAL_DECLARATION**	In CUTOVER SUMMARY	Text	First declaration made in ARIS	C CD CD-2000 D DC DC-2000
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**PLANT_SPECIES**	In CUTOVER SUMMARY	Text	Pine vs Spruce flag provided by operator	Pine Spruce NOT PROVIDED IN TIME FOR THIS SUBMISSION
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**HARV_AREA_HA**	In CUTOVER SUMMARY	Double	ARIS declared harvest area in ha	Decimal number
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**CUT ASSIGNED BCGRP**	In DECLARED STRATA	Text	Assigned broad cover group from ARIS reconciliation	C CD D DC ERROR
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**INTERTPR_U**		Text	Understory Interpreted TPR flag: Denotes if the interpreter over-rode the calculated TPR and supplied an interpreted TPR.	Null: AVI calculated TPR used I = Interpreted TPR used
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**MOD1_MODIFIER**		Text	Ostory Mod1 modifier	AD BU CC OC SN WF
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**MOD1_EXTENT**		Text	Ostory Mod1 Extent	1 2 3 4 5
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**MOD1_YEAR**		Text	Ostory Mod1 Year	Integer year value
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**MOD2_MODIFIER**		Text	Ostory Mod2 Modifier	AD BU CC OC

Table Name	Field Name	Populated into Flat Table from:	Field Type	Description	Unique Field Entries
					SN WF
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**MOD2_EXTENT**		Text	Ostory Mod2 Extent	1 2 3 4 5
temp FLATTABLE; Flat_Table_east; Flat_Table_West	**MOD2_YEAR**		Text	Ostory Mod2 Year	Integer year value
Flat_Table_east Flat_table_west	**Interpreted_Origin**	Origin_adjust_west Origin_adjust_east	Long Integer	AVI 10 year Origin class assigned by AVI interpreter: This is the one that was changed in 2010 adjustment	Integer 10 year decade class
Flat_Table_east Flat_table_west	**Modified_Origin**	Origin_adjust_west Origin_adjust_east	Long Integer	ORIGIN 10 year class derived from 2010 adjustment: This is the one used as "ORIGIN" in yields and net landbase.	Integer 10 year decade class
Flat_Table_east Flat_table_west	**Interpreted_TPR**	Origin_adjust_west Origin_adjust_east	TEXT	Overstory Timber Productivity Rating calculated using interpreted origin: Only populated for polys within scope of origin adjustment:	<NULL>=wasn't part of adjustment; U=Unmerch; F=Fair; M=Medium; G=Good
Flat_Table_east Flat_table_west	**Recalculated_TPR**	Origin_adjust_west Origin_adjust_east	Text	Overstory Timber Productivity Rating calculated using the modified origin: Only populated within scope of adjusted origin:	<NULL>=wasn't part of adjustment; U=Unmerch; F=Fair; M=Medium; G=Good
Flat_Table_east Flat_table_west	**ORIGIN_calc_FLAG**	Origin_adjust_west Origin_adjust_east	Long Integer	FLAG that denotes the record had a origin adjustment 2010 calc performed on it.	0 or null =polygon was not part of the adjustment2010 calculation; 1=polygon had an origin calculated during theadjustment2010 process
Flat_Table_east Flat_table_west	**ORIGIN_change_FLAG**	Origin_adjust_west Origin_adjust_east		FLAG that denotes whether the record:was changed during the origin adjustment 2010 calculation.	-1 or null = was not part of adjustment2010 calculation; 0 = adjustment2010 gave same origin as interpreted; 1 = adjustment2010 gave a different origin (ie the origin was modified)

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10.2 Shapefile Attributes

In the Woodstock modeling stage, the shapefile used for modeling has the required stratification items merged on and some additional Woodstock items are added. The shapefile attribute table (*westfma_apr28.dbf*) is used for the modeling. Table 10-2 contains the details of attributes in the shapefile attribute .DBF table.

Table 10-2. Data Dictionary for shapefile west_fma.dbf attributes used in modeling.

Field Name	Populated into Table from:	Field Type	Description	Unique Field Entries
FID	Generated by shapefile creation process	OID	Internal ID number	Integer Value
Shape	Generated by shapefile creation process	Geometry	System field used by ARC	
REMSOFT_ID	Woodstock	Integer	Remsoft internal unique ID used by model.	Unique integer values
REASONCODE	Woodstock	String		<blank> = Non-scheduled Flows = Non-scheduled Greenup = Non-scheduled Impossible = Non-scheduled In Solution = Scheduled Inoperable = Non-scheduled InoperableSp = Non-scheduled Not Needed = Non-scheduled
BESTPERIOD	Woodstock	Integer	Populated during model run – denotes optimal harvest period	Values from 0 to 8 = Optimal harvest period
CMPKEY	Temp MODEL_FOREST – Originates from composite forest creation process	Integer	COMPOSITE FOREST KEY : unique identifier of smallest entity in the final composite forest spatial product.	Integer values: P10 (also known as P19 North and VSA1) between 1000001 and 1078655. P19south (also known as VSA2 or P2/P1n/P11/P1) between 3000001 and 3287617 East FMA between 4000001 and 4499352

Field Name	Populated into Table from:	Field Type	Description	Unique Field Entries
CMPKEY_1	Duplicate of CMPKEY created during a merge of tables	Double	Duplicate caused by ARCMAP merge of two attribute tables – not used.	Integer values: P10 (also known as P19 North and VSA1) between 1000001 and 1078655. P19south (also known as VSA2 or P2/P1n/P11/P1) between 3000001 and 3287617 East FMA between 4000001 and 4499352
POLYID	Temp MODEL_FOREST – Originates from AVI VI Oracle process. Definitive source is Stand Poly table	Long	POLYGON ID : UNIQUE IDENTIFIER OF AVI SMALLEST ENTITY RECORD Each TWP-RGE-MER-PID unique combo (formerly called 'forestkey') has a unique polyid	Integer values auto generated by Oracle within VI program.
BLOCKS_UK	Blocks feature class in the input geodatabase Originating item is called "blocks_key".	Double	unique key from 'IN cutover summary' ' (Master update table that pulls all sources of past and future cuts together) Actual cuts up to 2010 season	I Integer values. Unique values represent a block fragment. One cutover may contain many fragments.nteger values. Unique values represent a block fragment. One cutover may contain many fragments.
CONTRIBUTE	Temp MODEL_FOREST Calculated during the net landbase forest stratification.	Long	Calculated field from forest stratification process. Flags polygons as belonging to net landbase or not.	1= in the net landbase 0 = not in the net landbase
TREEDAREAH	In Composite Forest West or in composite forest east. Definitive source is the composite forest attribute table from the input geodatabase. : TREEDAREAHA	Double	Area in Hectares of each composite forest polygon minus any overlapping seismic disturbance (seismic line buffered by 5m). Calculated in the net land base spatial processing steps.	Decimal numbers.
AREAHA	In Composite Forest West or in composite forest east.. Definitive source is the composite forest attribute table from the input geodatabase	Double	Total composite forest polygon AREA IN HECTARES. Shape_Area/10000 from the geodatabase final composite spatial product.	Decimal Numbers
TWP	In OSCOVER	Long	Township from AVI.	Integer values from 80 to 103
RGE	In OSCOVER	Long	Range from AVI	Integer values from 1 to 26
MER	In OSCOVER	Long	Meridian from AVI	Integer value 5 or 6
PID	In OSCOVER	Long	Polygon Identifier: unique to an interpreted polygon within a township,	Integer value between 1 and 9999
AGE_AT_INV	Temp MODEL_FOREST : AGE_AT_INVENTORY	Long	Age of the AVI forest polygon on day photo was flown. Calculated from ORIGIN and REFYEAR during forest stratification.	NULL = no origin ie non forested Integer value between 0 and 243.
STRBCGRP_C	In STAND DATA	Text	Character Code for Composite Broad Cover Group. Calculated during AVI processing	NULL – non forested C - Conifer CD – Conifer leading mixedwood DC – Deciduous leading

Field Name	Populated into Table from:	Field Type	Description	Unique Field Entries
				mixedwood D - Deciduous
AGE_YEARS_	Temp MODEL_FOREST : AGE(YEARS)	Long	AGE IN YEARS at time zero (May 1, 2009) calculated during forest stratification	NULL = no origin ie non forested Integer value between 0 and 249
RIS_LBASE	In STAND DATA	Text	LBASE as calculated by RIS - Composite weighting scheme used Present for future DMI internal use – not used for decisions in this submission	NULL – non forested C - Conifer CD – Conifer leading mixedwood DC – Deciduous leading mixedwood D - Deciduous
AGE_5_	Temp MODEL_FOREST : AGE(5)	Long	AGE IN NUMBER OF 5 YEAR PERIODS on May1, 2009	NULL or 0 = no origin ie non forested Integer value between 1 and 50
STRATIFICA	Temp MODEL_FOREST : STRATIFICATION TYPE	Text	Type of stratification method used to update cutblocks or fires. Calculated by the forest stratification process. Maintained as an aid in debugging anomalies.	AVI NON-TREED CUT ASSIGNED YC ASSIGNED AGE CUT ASSIGNED YC ASSIGNED AGE - BURN MOD CUT AVI YC ASSIGNED AGE CUT AVI YC AVI AGE DEFAULT AVI POST AVI BURN ref-cc-burn REMOVALS NON MERCH RETENTION
AGE_10_	Temp MODEL_FOREST :AGE(10)	Long	AGE IN NUMBER OF 10 YEAR PERIODS on May1, 2009	NULL = no origin ie non forested Integer value between 1 and 25
ASSIGNED_P	Temp MODEL_FOREST : ASSIGNED_PATHWAY	Long	Yield Curve Stratum assigned by the cutover stratification and/or forest stratification processes. This is the final overwrite going into the TSA model.	Integer value from 0 to 13
CUT_PERIOD	Woodstock populated. (The net landbase contained preschedules in this field that were translated into a Woodstock input file – they are still present in this final populated version along with the model selections added)	Long	10 year CUT PERIOD that the MODEL scheduled.	NULL – not scheduled by model Integer value between 0 to 7 = Period of harvest
ACTION	Woodstock populates from model run	Long	MODELED ACTION	0 = Death 1 = Core D 2 = Core C 3 = Contingency D 4 = Contingency C 5 = Contingency D 6 = Contingency C null = not populated
BLOCK	Woodstock	String	Alphanumeric unique identifier code written	alphanumeric code.

Field Name	Populated into Table from:	Field Type	Description	Unique Field Entries
			and used by Woodstock to identify collections of polygons treated as entities within the model runs.	
PREBLOCK	In WEST PREBLOCK; in EAST PREBLOCK	Text	PREBLOCK FLAG (Y or Null) Manual selections written into the net lbase tables to force the model to harvest selected stands.	Null = do not tell Woodstock to cut this Y = Tell Woodstock to cut this
OPER	In WEST PREBLOCK; in EAST PREBLOCK	Text	OPERator of the specified pre block or scheduled block. The final spatial sequence contains an entry here for the company expected to harvest the block in period 1 (2 periods for Boucher in P4)	NULL = no operator assigned CFP = CanFor DMI = DMI ZAV = Zavisha Sawmills Tolko = Tolko Zav=Zavisha BUCH= Buchannan BOUCH = Boucher MTU= Alberta Seehta
THEME1	Temp MODEL_FOREST	Text	Theme1 in Woodstock : Yield Curve assigned	0 to 13
THEME2	Temp MODEL_FOREST	Text	Theme2 in Woodstock model: LandBase	LCIN – Contributing Conifer Landbase LCSEN – Contributing conifer landbase on rugged terrain LDIN – Deciduous contributing landbase LDSEN – Contributing Deciduous landbase on rugged terrain LE – EMEND landbase noncontributing landbase OTHER – Noncontributing landbase
THEME3	Temp MODEL_FOREST	Text	Theme3 in Woodstock model : Status	BURN – Recent burn LINEAR – LandUse deletion MAN – Managed (known cutover) NAT – Natural stand OTHER- non-forest RET – Retention patch
THEME4	Temp MODEL_FOREST	Text	Theme4 in Woodstock model : Forest Management Unit by which decisions are to be made in the DFMP	West FMA: P10 P11 P1N P1S P2 East FMA:: P3 P4 P5 F1 S15
THEME5	Temp MODEL_FOREST	Text	Theme5 in Woodstock model :Mountain Pine Beetle Susceptibility. Placeholder at this time not used.	Zz – placeholder - Item not used
THEME6	Temp MODEL_FOREST :	Text	Theme6 in Woodstock Model – Cost Zones	'D'& <integer value from 1 to 75> & 'C' & <integer value from 1 to 75>

Field Name	Populated into Table from:	Field Type	Description	Unique Field Entries
	Assigned during stratification		Concatenated field that merges the deciduous cost zone & the conifer cost zone. Zones are selected for the most appropriate mill location for a given product	
THEME7	Temp MODEL_FOREST : Originates in composite forest input data sets : PFRA watershed boundaries.	Text	Watershed Catchment	105 = 116 = 137 = 140 = 141 = 145 = 149 = 154 = 172 = 194 = 202 = 209 = 210 = 217 = 219 = 227 = 231 =
SD_FLAG	Temp MODEL_FOREST	Long	SUBJECTIVE DELETION FLAG marks whether the stratification process has deleted this poly for a known SD	0 = not a subjective deletion 1= is a subjective deletion
FMU	In OSCOVER	Text	Forest Management Unit from AVI – Old ones used because they still have political and business relevance – they are required for decision making in this DFMP	West FMA: P10 P11 P1N P1S P2 East FMA: P3, P4, P5, F1, S15
FMU2	In CUTOVER SUMMARY	Text	Forest Management Unit assigned to cutblocks- Workaround for slivers of blocks that stray over FMU lines and would otherwise cause false reporting.	West FMA: P10 P11 P1N P1S P2 East FMA: P3, P4, P5, F1, S15
NEW_FMU	In COMPOSITE FOREST WEST	Text	Current official Forest Management Unit	P19 FOR West P3, P4, P5, F1, S15 for East
VSA	In COMPOSITE FOREST WEST	Text	Volume Supply Area label for west fma volume supply areas	VSA1 = P10 (or P19 North) VSA2 = P1&P2&P11 (or P19 south)
CATCHKEY	In COMPOSITE FOREST WEST	Text	CATCHMENT KEY: IDENTIFIER OF WATERSHED: Also the	105 116 137

Field Name	Populated into Table from:	Field Type	Description	Unique Field Entries
	In COMPOSITE FOREST EAST Originates in composite forest inputs from PFRA watershed layer.		foreign key to link into the input geodatabase. These are the PFRA gauged watersheds aligned with the HYDAT data.	140 141 145 149 154 172 194 202 209 210 217 219 227 231
FMA_FLAG	Temp MODEL_FOREST	Long	Inside FMA Flag	0=Outside FMA 1= Inside FMA
HEIGHT	In STAND DATA	Long	Height in 1 m classes	-1 = nonforest Integer Values from 0 to 34
HT6M	In STAND DATA	Integer	Height in 6 m classes – carry over from Phase3 methods.	-1=nonforest Integer values from 0 to 6
TPR	In STAND DATA	Text	Overstory Timber Productivity Rating assigned by photo interpreter. – This is the one used in yields and net landbase.	Null= not a productive forest type U=unproductive forest F=fair M=medium G=good
BLK_DET_ID	In CUTOVER SUMMARY Originates in BLK Details Table – DMI's internal use list of known block data	Double	Unique identifier assigned to each record in the Blocks Details table (from table: in CUTOVER SUMMARY)	Integer values 1 to 23587
NONFOR	In STAND DATA : nonforest	Text	Non Forest Calls: Multiple AVI Ostory fields contain non-forest categories. These are pulled together in one field for internal DMI queries to add efficiencies	NULL = not a nonfor; must be forested A HF HG IF IG IH II IP IW MB MC MS P SC SO SR WF WL WR
OPEN_NUM	In CUTOVER SUMMARY	Text	ARIS Opening number	Alphanumeric code
BLOCK_ID	In CUTOVER SUMMARY	Text	Number assigned to block when harvested, if known. Only Unique within a license within a timber year	Alphanumeric code
CALC_LBASE	In STAND DATA : calc_lbase	Text	Calculated Landbase from Composite Broad Cover Group	LC LD XX

Field Name	Populated into Table from:	Field Type	Description	Unique Field Entries
	This same item appears in the flat tables as "calc_lbase2"			
HARV_STAT	In CUTOVER SUMMARY	Text	Harvest status- Has it been cut?	Null CUT
BLK_STATUS	In CUTOVER SUMMARY	Text	BLOCK STATUS from BLOCKS feature class: CUT- block cut and photo confirmed, PLANNED - block laid out with GPS, FUTURE - future block, RET_INT - retention internal to block, RET_EXT - retention external to block (from table: in CUTOVER SUMMARY)	NULL – not used anymore
REGEN_CODE	In DECLARED STRATA	Text	Declared Stratum C, CD, DC, D (from table: in DECLARED STRATA)	C-2000 CD-2000 CONIFER D-2000 DC-2000 PR91 XX
BLOCKS_KEY	IN COMPOSITE FOREST WEST Originates in Blocks feature class	Double	Unique identifier of record from blocks input feature class (from table:temp COMPOSITE FOREST)	Integer value
FMA	IN COMPOSITE FOREST WEST	Double	FMA flag: 0 - not within the FMA, 1 - within the FMA	0 = not in FMA 1 = inside fma
COMPARTMEN	IN COMPOSITE FOREST WEST : COMPARTMENT	Text	DMI Compartment name/number	NOT POPULATED IN THIS SUBMISSION
PATHWAY1	Temp MODEL_FOREST Originates in VI_STRATA	Long	PATHWAY ASSIGNED IN 2011 YIELD CURVE METHODOLOGY : Default yield curve stratification based on AVI attributes before any overrides from newer update information. 'Yield Curve assigned on day of AVI photo using only AVI information'	Integer value from 0 to 13
PATHLABEL	Temp MODEL_FOREST Originates in VI_STRATA	Text	TEXT LABEL DESCRIBING THE PATHWAY ASSIGNED IN 2011 YIELD CURVE METHODOLOGY	PATHLABEL Aspen>>EarlyMixed>>WhiteSpruce Aspen>>LateMixed>>WhiteSpruce Aspen>>Shrub Aspen>>WhiteSpruce AspenMixed>>WhiteSpruce BalsamPoplar>>Shrub BlackSpruce BlackSpruce-Pine/Whitespruce Deciduous-Pine-BlackSpruce NFC Pine Pine-BlackSpruce-Deciduous Pine-WhiteSpruce Wspruce>>WhiteSpruce
TRAPNO	IN COMPOSITE FOREST WEST	Text	Trap line number (provincial unique identifier)	NOT POPULATED IN THIS SUBMISSION

Field Name	Populated into Table from:	Field Type	Description	Unique Field Entries
ZONENUM	IN COMPOSITE FOREST WEST	Text	Number assigned to each compartment (cost zone). Only unique within one sustainable yield unit	NOT POPULATED IN THIS SUBMISSION

10.3 Spatial Harvest Sequence

The final stage of DFMP preparation was to assign company names to individual blocks for the first period. The results of this exercise are presented in a geodatabase called *"west_pfhs2009_70yr"*. The attributes of the 70 year sequence are pulled out into a MS-Access file called *"west_pfhs2009_70yr.accdb*". Table 10-3 presents to details of the sequence attributes.

Table 10-3. Data Dictionary for West FMA 70 spatial harvest sequence attribute table "west2009_70yr_att".

Field Name	Populated into Table from:	Field Type	Description	Unique Field Entries
OBJECTID	Generated by shapefile creation process	Double	Internal ID number	Unique Integer Value
REMSOFT_ID	Woodstock	Integer	Remsoft internal unique ID used by model.	Unique integer values
REASONCODE	Woodstock	String		<blank> = Non-scheduled Flows = Non-scheduled Greenup = Non-scheduled Impossible = Non-scheduled In Solution = Scheduled Inoperable = Non-scheduled InoperableSp = Non-scheduled Not Needed = Non-scheduled
BESTPERIOD	Woodstock	Integer	Populated during model run – denotes optimal harvest period	Values from 0 to 8 = Optimal harvest period
CMPKEY	Temp MODEL_FOREST – Originates from composite forest creation process	Integer	COMPOSITE FOREST KEY : unique identifier of smallest entity in the final composite forest spatial product.	Integer values: P10 (also known as P19 North and VSA1) between 1000001 and 1078655. P19south (also known as VSA2 or P2/P1n/P11/P1) between 3000001 and 3287617 East FMA between 4000001 and 4499352
CONTRIBUTE	Temp MODEL_FOREST Calculated during the net landbase forest stratification.	Long	Calculated field from forest stratification process. Flags polygons as belonging to net	1= in the net landbase 0 = not in the net landbase

Field Name	Populated into Table from:	Field Type	Description	Unique Field Entries
			landbase or not.	
TREEDAREAH	In Composite Forest West or in composite forest east. Definitive source is the composite forest attribute table from the input geodatabase. : TREEDAREAHA	Double	Area in Hectares of each composite forest polygon minus any overlapping seismic disturbance (seismic line buffered by 5m). Calculated in the net land base spatial processing steps.	Decimal numbers.
AREAHA	In Composite Forest West or in composite forest east.. Definitive source is the composite forest attribute table from the input geodatabase	Double	Total composite forest polygon AREA IN HECTARES. Shape_Area/10000 from the geodatabase final composite spatial product.	Decimal Numbers
TWP	In OSCOVER	Long	Township from AVI.	Integer values from 80 to 103
RGE	In OSCOVER	Long	Range from AVI	Integer values from 1 to 26
MER	In OSCOVER	Long	Meridian from AVI	Integer value 5 or 6
PID	In OSCOVER	Long	Polygon Identifier: unique to an interpreted polygon within a township,	Integer value between 1 and 9999
AGE_10_	Temp MODEL_FOREST :AGE(10)	Long	AGE IN NUMBER OF 10 YEAR PERIODS on May1, 2009	NULL = no origin ie non forested Integer value between 1 and 25
CUT_PERIOD	Woodstock populated. (The net landbase contained preschedules in this field that were translated into a Woodstock input file – they are still present in this final populated version along with the model selections added)	Long	10 year CUT PERIOD that the MODEL scheduled.	NULL – not scheduled by model Integer value between 0 to 7 = Period of harvest
ACTION	Woodstock populates from model run	Long	MODELED ACTION	0 = Death 1 = Core D 2 = Core C 3 = Contingency D 4 = Contingency C 5 = Contingency D 6 = Contingency C null = not populated
BLOCK	Woodstock	String	Alphanumeric unique identifier	alphanumeric code.

Field Name	Populated into Table from:	Field Type	Description	Unique Field Entries
			code written and used by Woodstock to identify collections of polygons treated as entities within the model runs.	
PREBLOCK	In WEST PREBLOCK; in EAST PREBLOCK	Text	PREBLOCK FLAG (Y or Null) Manual selections written into the net lbase tables to force the model to harvest selected stands.	Null = do not tell Woodstock to cut this Y = Tell Woodstock to cut this
OPER	In WEST PREBLOCK; in EAST PREBLOCK	Text	OPERator of the specified pre block or scheduled block. The final spatial sequence contains an entry here for the company expected to harvest the block in period 1 (2 periods for Boucher in P4)	NULL = no operator assigned CFP = CanFor DMI = DMI ZAV = Zavisha Sawmills Tolko = Tolko Zav=Zavisha BUCH= Buchannan BOUCH = Boucher MTU= Alberta Seehta
THEME1	Temp MODEL_FOREST	Text	Theme1 in Woodstock : Yield Curve assigned	0 to 13
THEME2	Temp MODEL_FOREST	Text	Theme2 in Woodstock model: Landbase	LCIN – Contributing Conifer Landbase LCSEN – Contributing conifer landbase on rugged terrain LDIN – Deciduous contributing landbase LDSEN – Contributing Deciduous landbase on rugged terrain LE – EMEND landbase non-contributing landbase OTHER – Non-contributing landbase
THEME3	Temp MODEL_FOREST	Text	Theme3 in Woodstock model : Status	BURN – Recent burn LINEAR – Land Use deletion MAN – Managed (known cutover) NAT – Natural stand OTHER- non-forest RET – Retention patch
THEME4	Temp MODEL_FOREST	Text	Theme4 in Woodstock model : Forest Management Unit by which decisions are to be made in the DFMP	West FMA: P10 P11 P1N P1S P2 East FMA:: P3 P4 P5 F1 S15
THEME5	Temp MODEL_FOREST	Text	Theme5 in Woodstock model :Mountain Pine Beetle	Zz – placeholder - Item not used

Field Name	Populated into Table from:	Field Type	Description	Unique Field Entries
			Susceptibility. Placeholder at this time not used.	
THEME6	Temp MODEL_FOREST: Assigned during stratification	Text	Theme6 in Woodstock Model – Cost Zones Concatenated field that merges the deciduous cost zone & the conifer cost zone. Zones are selected for the most appropriate mill location for a given product	'D'& <integer value from 1 to 75> & 'C' & <integer value from 1 to 75>
THEME7	Temp MODEL_FOREST: Originates in composite forest input data sets : PFRA watershed boundaries.	Text	Watershed Catchment	105 = 116 = 137 = 140 = 141 = 145 = 149 = 154 = 172 = 194 = 202 = 209 = 210 = 217 = 219 = 227 = 231 =
FMU	In OSCOVER	Text	Forest Management Unit from AVI – Old ones used because they still have political and business relevance – they are required for decision making in this DFMP	West FMA: P10 P11 P1N P1S P2 East FMA: P3, P4, P5, F1, S15
VSA	In COMPOSITE FOREST WEST	Text	Volume Supply Area label for west fma volume supply areas	VSA1 = P10 (or P19 North) VSA2 = P1&P2&P11 (or P19 south)
CATCHKEY	In COMPOSITE FOREST WEST In COMPOSITE	Text	CATCHMENT KEY: IDENTIFIER OF WATERSHED: Also the foreign key	105 116 137 140

Field Name	Populated into Table from:	Field Type	Description	Unique Field Entries
	FOREST EAST Originates in composite forest inputs from PFRA watershed layer.		to link into the input geodatabase. These are the PFRA gauged watersheds aligned with the HYDAT data.	141 145 149 154 172 194 202 209 210 217 219 227 231
TRAPNO	IN COMPOSITE FOREST WEST	Text	Trap line number (provincial unique identifier)	NOT POPULATED IN THIS SUBMISSION
OP_AREA	IN COMPOSITE FOREST	TEXT	DMI operating area symbology codes used for mapping	Populated for 1st period spatial harvest sequence BN-MearonC BO-McLeanC BO-SweenyC BO-West CC-HaroC CC-West CH-Worsley CR-ClearR DH-HinesC DH-P2100 DH-WhitemudT KE-HawkHillsT KR-BothaR KR-KegR KR-KegT KR-SmeatonC KR-TwinL KR-VaderC KR-VestaC NO-NotikewanR RL-DoigR RL-DoigT RL-WhitemudR ST-EurekaR ST-RamblingC ST-WhitemudR SU-CubL SU-NotikewinR SU-P2200
COMPARTMENT	IN COMPOSITE FOREST WEST :	Text	DMI Compartment name/number	Populated for 1st period spatial harvest sequence: Boundary Boundary North Chinchaga Clear Hills Clear River Deer Hill Keg River Kemp River Notikewan Running Lake Stoney Lakes Sulphur Lake
OP_AREA_NAME	IN COMPOSITE FOREST WEST	TEXT		Populated for 1st period spatial harvest sequence Mearon Creek McLean Creek Sweeny Creek West

Field Name	Populated into Table from:	Field Type	Description	Unique Field Entries
				Haro Creek West Worsley Clear River Hines Creek P2-100 Whitemud Tower Hawk Hills Tower Botha River Keg River Keg Tower Smeaton Creek Twin Lakes Vader Creek Vesta Creek Notikewan River Doig River Doig Tower Whitemud River Eureka River Rambling Creek Whitemud River Cub Lakes Notikewin River P2-200
Shape_Length	IN COMPOSITE FOREST WEST	Double	Shapefile auto generated polygon perimeter in metres	Decimal number
SHAPE_Area	IN COMPOSITE FOREST WEST	Double	Shapefile auto generated polygon area in metres squared	Decimal number
SWVOL	Woodstock Spatial Playback	Double	Softwood volume harvested in the period during which Woodstock scheduled this polygon. This is the accumulated harvest for this polygon – ie it is not a yield/ha. There is no accounting for retention.	Decimal number representing m3 cut in the polygon.
HWVOL	Woodstock Spatial Playback	Double	Hardwood volume harvested in the period during which Woodstock scheduled this polygon. This is the accumulated harvest for this	Decimal number representing m3 cut in the polygon.

Field Name	Populated into Table from:	Field Type	Description	Unique Field Entries
			polygon – ie it is not a yield/ha. There is no accounting for retention	
CORE_CONT	Manual assignment during SHS block allocation	TEXT	Label manually calculated during block assignments of the 1st period blocks. It combines landbase (" who owns this block?") and the relative cost zone for the primary operator – either core or contingency.	CONT_C = Conifer Block in conifer contingency CONT_D = Deciduous block in deciduous contingency CORE_C = Conifer block in conifer Core CORE_D = Deciduous Block in deciduous Core

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11 Appendix 5 – Water Yield Analysis

Forecasting of the impact of timber harvesting on water yield is required under the Planning Standard (Annex 1, Section 5.9.13 and Annex 4, Objective 3.2.1.1). This was accomplished through the use of the ECA-Alberta model to generate decadal hydrologic yield increase curves. The curves were incorporated into Woodstock to dynamically calculate the increase in water yield for each watershed catchment area, which was then constrained to a maximum of 15% yield increase per catchment.

11.1 Development of hydrologic yield increase curves

The model chosen to evaluate water yield impacts was ECA-Alberta. Primary inputs required for the ECA-Alberta model include average stream flow and average precipitation.

11.1.1 Average Stream Flow

Average stream flow was extracted for hydrometric gauging stations located throughout the province. GIS locations for the gauging stations were downloaded from Agriculture and Agri-food Canada[1]. Stream flow data for each gauging station was downloaded from Environment Canada – Water Survey of Canada[2].

The Prairie Farm Rehabilitation Administration (PFRA) provides digital polygon data for gross watershed boundaries for the Canadian prairies. The watershed boundaries have been defined on the basis of the hydrometric gauge locations, and each gross watershed polygon indicates the area that drains to a single gauge. Only those PFRA watersheds that have >= 50% of their area on the DMI FMA area and with stream flow data were utilized for this water yield analysis.

Of the 16 watersheds that intersect the west FMA area, 5 have at least 50% of their area within the FMA area, and all 5 of those have stream flow data. The calculated average stream flow to be utilized for the west FMA area is 76 mm.

[1] http://www4.agr.gc.ca/AAFC-AAC/display-afficher.do?id=1228407260356&lang=eng
[2] http://www.wsc.ec.gc.ca/applications/H2O/index-eng.cfm

11.1.2 Average Precipitation

Annual precipitation data (including rain and snow) is available from Environment Canada[3]. Weather stations in and around the FMA area were used to determine the average annual precipitation. For the west FMA area, the average annual precipitation used for the analysis was 450 mm.

11.1.3 ECA-Alberta modeling

The ECA-Alberta model was run with a single disturbance of 100-ha covering a watershed of 100-ha (i.e., a single disturbance covering 100% of the watershed). In this way, the resulting outputs (ECA% and water yield increase %) reflect the recovery curves for an individual harvested stand. The following parameters were used in the ECA-Alberta model.

- Species code: One run for each of the three species groups accepted by ECA-Alberta (hardwood, pine, and spruce/larch/fir)
- Stand area: 100-ha
- Year of disturbance: 1999
- Site Quality: one run for each TPR (G, M, F)
- Hydrologic recovery function: based on annual volume growth
- Simulation type: ECA and projected change in annual water yield
- Watershed area: 100 ha
- Average precipitation (mm): 450 mm
- Average stream flow (mm): 76 mm
- Starting year: 1999
- Simulation duration: 100 years
- Simulation time step: 1 year

With 1999 as the disturbance year, the ECA-Alberta model does not show any ECA or water yield increase until the year 2000. Therefore, to coincide with the 10-year timber supply model, the 10-year average values for ECA and water yield increase were used. Thus, period 1 ECA was the simple average of the ECA values for the years 2000 to 2009, period 2 ECA was the average of years 2010 to 2019, etc.

The result was 18 curves: 3 species groups * 3 TPR * 2 recovery curves (ECA & water yield increase).

11.1.4 Woodstock Modeling

Incorporating the recovery curves into the Woodstock model formulation required further modifications. Individual yield strata were assigned to one of the 3

[3] http://climate.weatheroffice.gc.ca/climate_normals/index_e.html

possible species groups. The 3 TPR curves for each species were weighted by net area in each TPR and combined into a single curve. The final result was 2 curves for each yield strata: ECA and water yield increase.

Woodstock outputs were then created to track the ECA and water yield increases by watershed, which then permitted constraints to be applied to individual watersheds.

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12 APPENDIX 6: Spatial Analysis of Buffering of Recurring Streams

12.1 Background

DMI submitted the net land base for the West FMA in February 2011 and the net land base for East FMA in August 2011. During follow up meetings in April 2011, ASRD postulated that the government's stream data was of better quality than the DMI-used government stream data. The DMI data has been edited over the past 20 years to correct errors and label stream segments appropriately as field work confirmed it. ASRD was specifically concerned that a stream category called 'intermittent recurring' was not buffered in the land base submissions (the DMI data does not contain such a category).

ASRD further estimated that the resultant AAC from the plans using these net land bases would be significantly overestimated. The plan development team did not want to delay the overall plan development by requiring new net land bases be re-compiled. Instead, it was agreed that DMI would measure the difference in affected net contributing landbase and ASRD would apply that difference when allocating AAC. This report explains the findings of the investigation.

12.2 Calculations

12.2.1 Goal

The goal was to establish the net additive area of contributing landbase affected by stream buffers using the ASRD layer as opposed to the DMI layer.

12.2.2 Steps

The following steps were done in analyzing the potential differences between DMI's water buffers and the buffers created using the Government's water layer.

12.2.2.1 Step 1 – Create two buffer layers

Using the Government water as provided, the water arcs were buffered using the same criteria as that of DMI's:

- Lakes – 100m
- Rivers – 60m
- Perennial and Recurring streams – 32m

DMI's lake layer (built from provincial base and AVI water polygons) was used to create the Lake buffers.

The Provincial swan lakes layer was used to make the swan buffers.

All of the above were merged together to form the *government buffers layer.*

The *DMI buffers layer* was built by combining the buffers taken from the net landbase submissions.

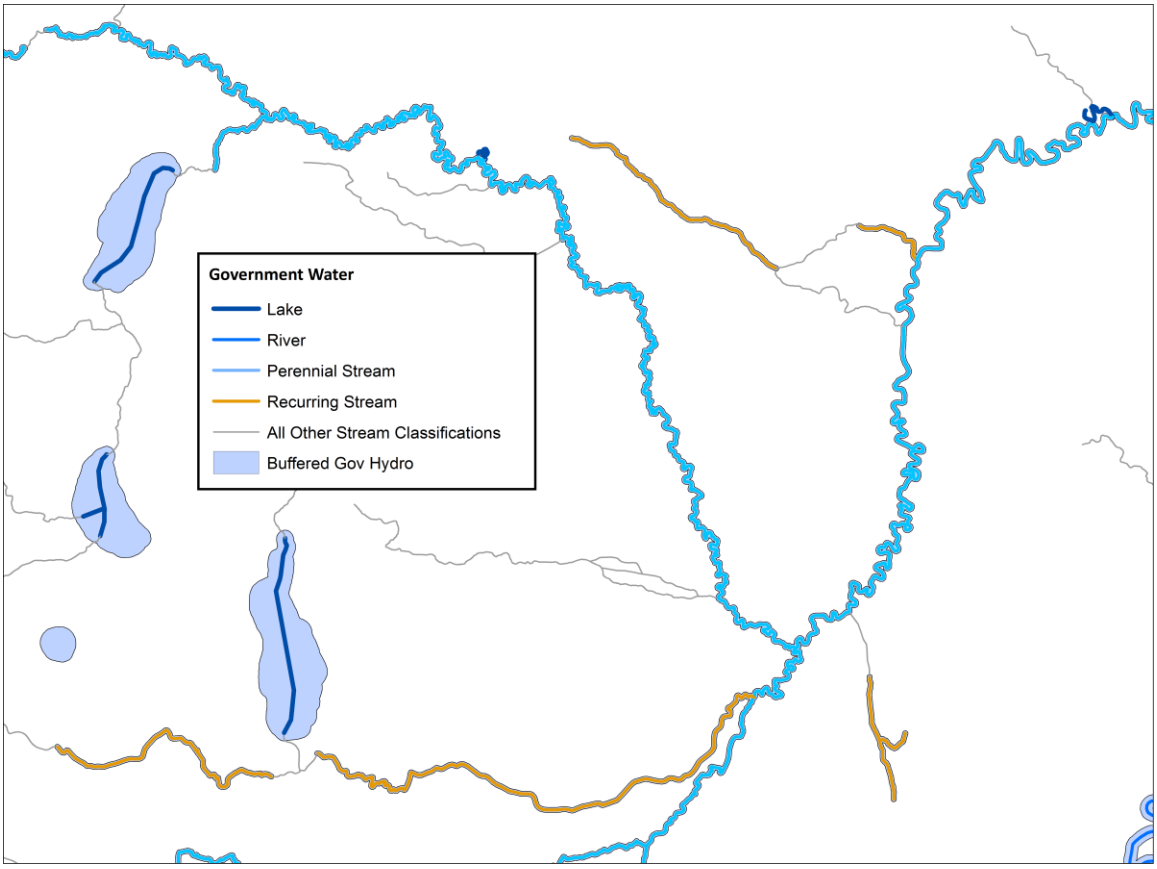


Figure 29. Sample map scene showing the recurring intermittent buffers on the Government Buffer layer

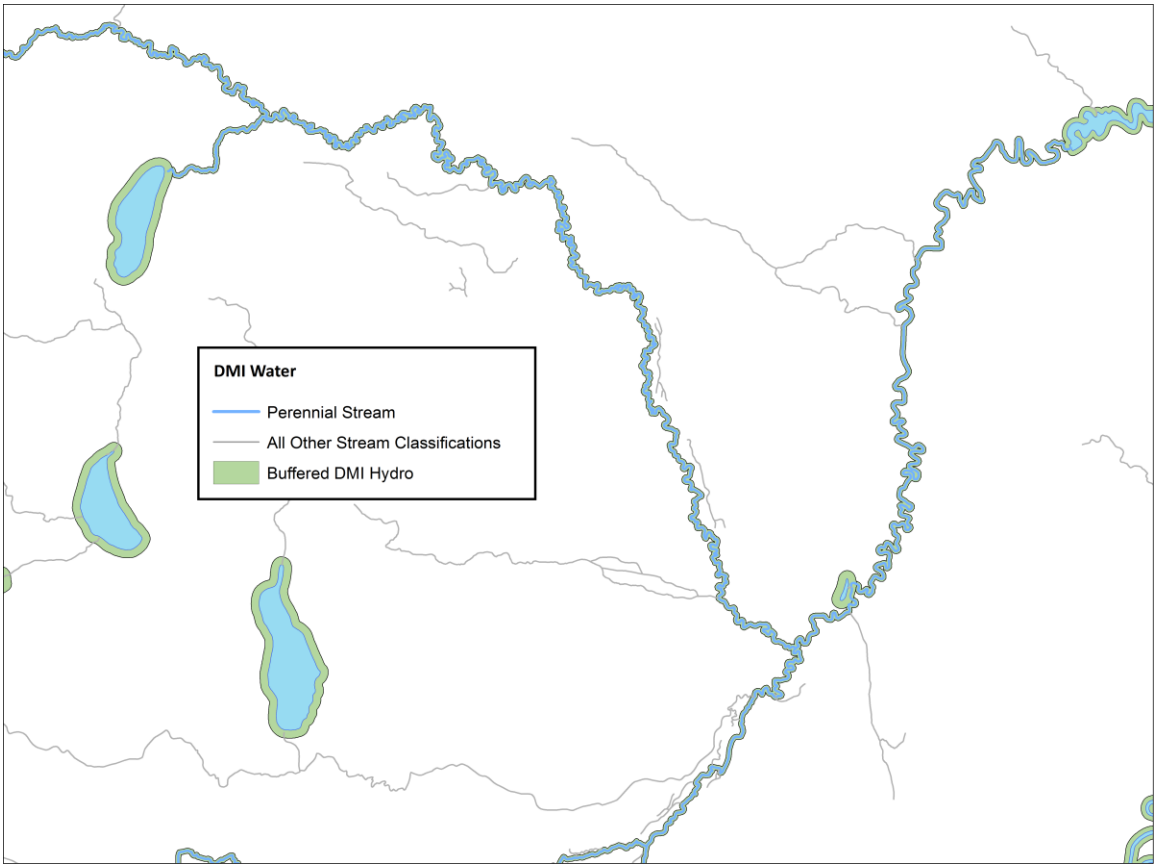


Figure 30. Sample map scene showing the DMI Buffer layer.

12.2.2.2 Step 2 – Create the Additive Buffers Layer

The DMI buffer layer was overlain on the government buffer layer. Intersected areas on the government buffer layer were erased. The resultant layer is referred to as *the additive buffer layer.*

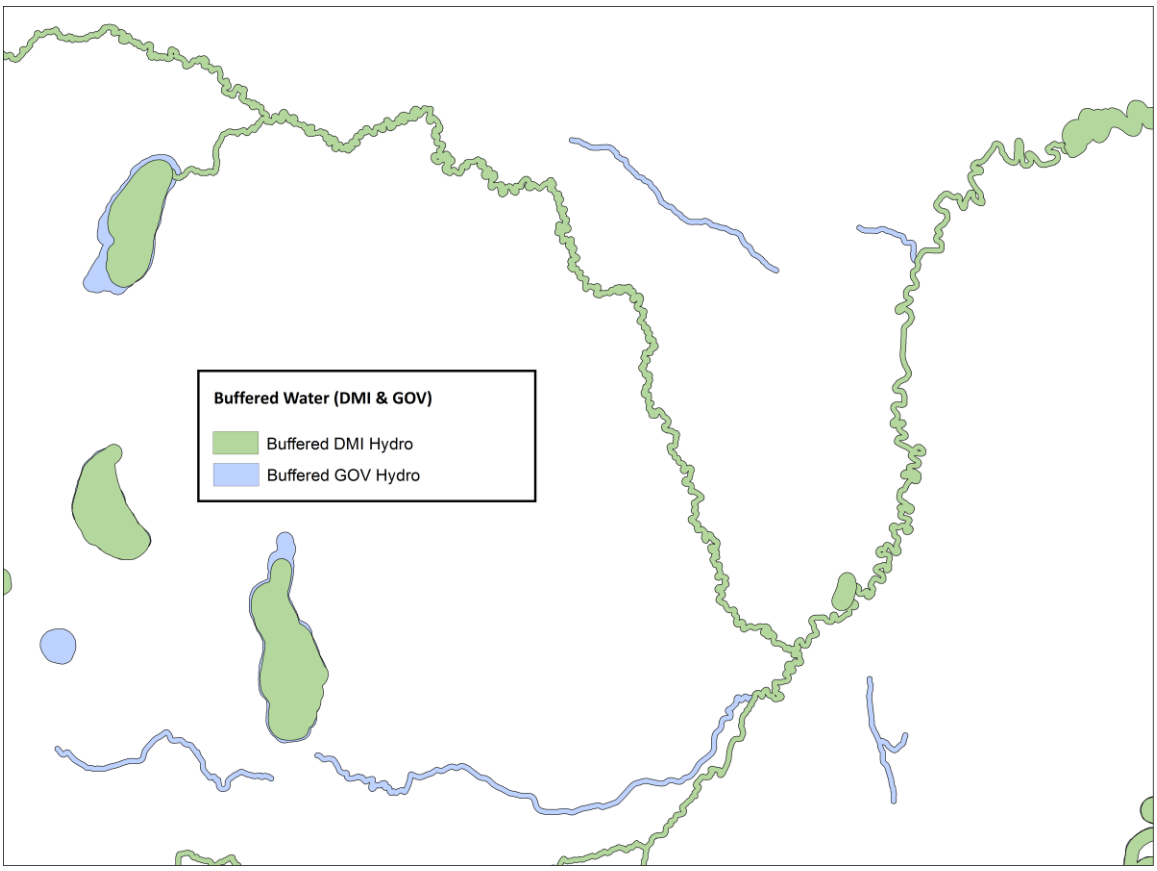


Figure 31. Sample map scene showing the DMI layer erasing portions of the government layer to leave the resultant differences.

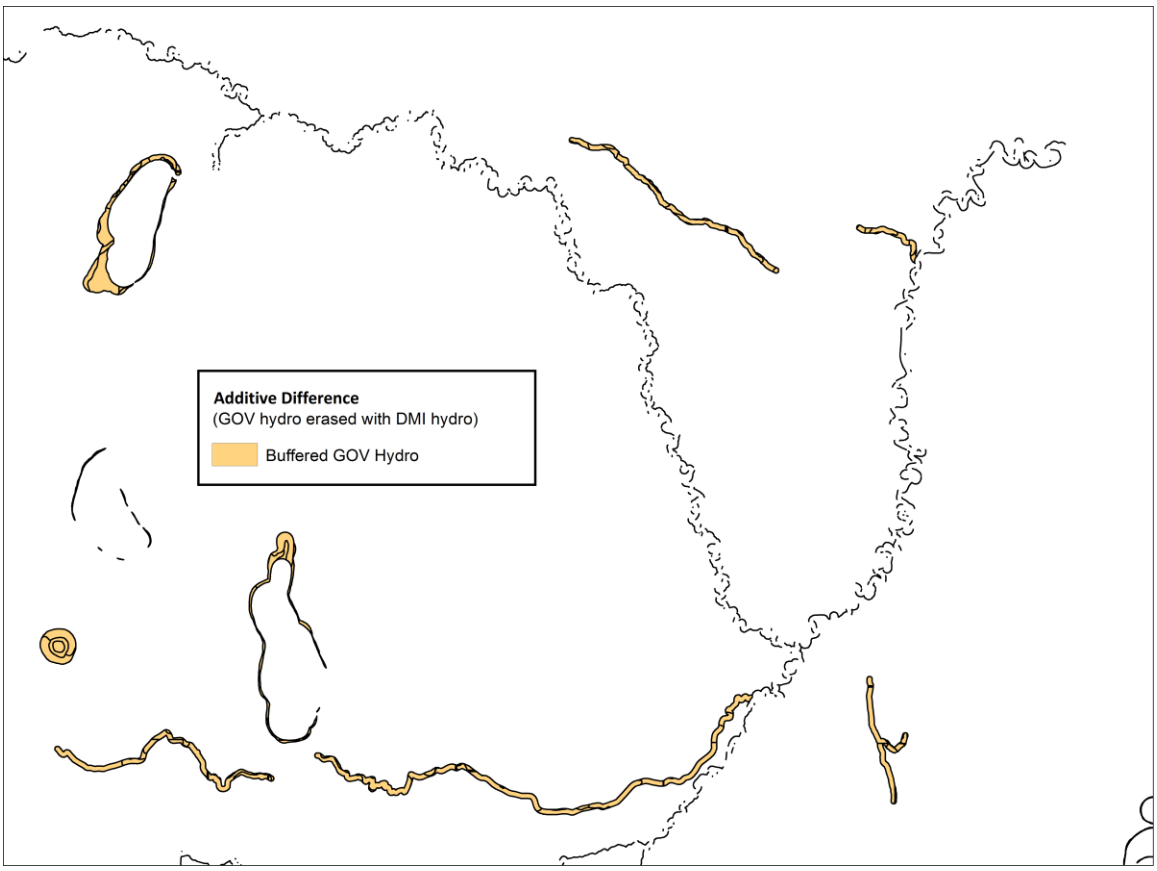


Figure 32. Sample map scene showing the resultant additive buffer layer.

12.2.2.3 Step3 – Intersect the Additive Layer with the Composite Forest

The additive layer was intersected with the net landbase composite forest to enable detailed analyses of what is impacted by this potential change.

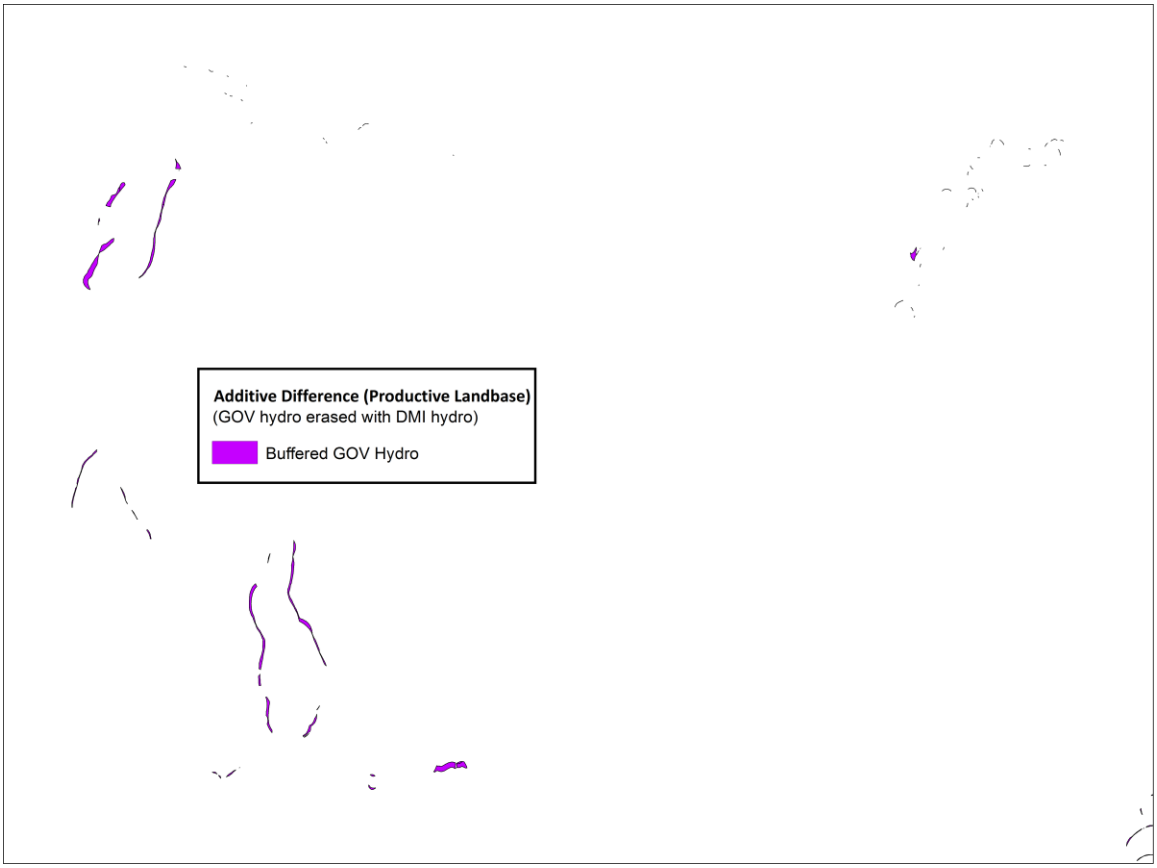


Figure 33. Sample map scene showing the net contributing landbase affected by the additive buffer layer.

12.2.2.4 Step4 – Summarize Affected Productive Land Base

The productive contributing land base within the additive area was summarized.

FMA	Contributing Land Base Area (ha)	Affected Area (contributing land base)	Percentage Affected
FMA0900044 (east)	869413	4427.3	0.51%
FMA0900045 (west)	597927	13549.1	2.27%

12.2.2.5 Step5 – Intersect the Additive Layer with the Spatial Harvest Sequence

The contributing landbase portion of the additive layer was intersected with the 70 year spatial harvest sequence. Detailed summaries were produced. The actual impacted portion of both spatial sequences was less than that of the total contributing landbase.

Table 4. Impact of additive buffer area on spatial harvest sequence in FMA0900044 (FMA East).

PERIOD	Period Cut Area (ha)	Additive contributing hectares within the period schedule	Percentage of period harvest affected by additive contributing hectares
1	70,850	264.6	0.37%
2	72,711	271.3	0.37%
3	72,789	352.3	0.48%
4	69,056	275.5	0.40%
5	68,793	352.2	0.51%
6	75,166	366.5	0.49%
7	79,486	339	0.43%
Total	**508,851**	**2221.4**	**0.44%**

Table 5. Impact of additive buffer area on spatial harvest sequence in FMA0900045 (FMA West).

PERIOD	Period Cut Area (ha)	Additive contributing hectares within the period schedule	Percentage of period harvest affected by additive contributing hectares
1	59,684	1130.4	1.89%
2	53,491	1213.5	2.27%
3	51,129	974.1	1.91%
4	47,048	819.8	1.74%
5	46,213	921.9	1.99%
6	46,232	1053.9	2.28%
7	44,150	1036	2.35%
Total	**347,946**	**7149.6**	**2.05%**

12.3 Recommendations

Given the following:

- Growth & Yield estimates are designed to be within +- 20%;
- The provincial base data categories do not align with the ground rule categories of stream classifications;
- The government stream data contains large errors that have been fixed in DMI's layer (these are not accounted for in this investigation and therefore this impact is an overestimate – the DMI fixes actually mitigate the apparent difference in buffer area);
- There are apparent significant stream data quality issues in the government layer:
    - intermittent streams not connecting to any water features
    - Intermittent stream density abruptly changing at township and FMU boundaries
    - Large polygonal water features represented by arcs in the government data
- DMI uses Lidar DEM and wet areas mapping for actual ground level planning of stream protection;

It is recommended that the current buffers in the two net land bases be allowed to remain as they were submitted. No AAC scaling should be applied.

DAISHOWA-MARUBENI INTERNATIONAL LTD.
Peace River Pulp Division

P19 Targets and Implementation Detailed Forest Management Plan

FMA 0900045
2009-2018

May 11, 2012

FMA 0900045 Targets & Implementation
DFMP 2009 - 2018

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1: Document Scope

This document presents detailed description of the forest management targets and implementation plan for DFMP 2009-2018 for the DMI FMA 0900045 (west FMA). This document describes:

- Corporate Overview
- Values, Objectives, Indicators, and Targets (VOITs) required under Annex 4 of the planning standard.
- Values, Objectives, Indicators, and Targets (VOITs) voluntarily subscribed to by DMI for CSA Z809
- Preferred Management Strategy
- Spatial Harvest Sequence
- AAC Allocation
- Comparison to Past Plans
- Timber Depletion Accounting
- Forest Operations
- Access Management
- Forest Protection Strategies
- Retention
- Sensitive Species Management
- Economic Benefits
- Aboriginal Engagement
- Public Advisory Committee
- Reporting & Monitoring

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2: Corporate Overview

This forest management plan directly impacts the forest management affairs of four companies holding timber tenures on FMA 0900045:

- Daishowa Marubeni International Limited – Peace River Pulp Division
- Canfor – Grande Prairie Sawmill Division
- Zavisha Sawmills Ltd
- Tolko - High Level Lumber Division

2.1 Daishowa Marubeni International Limited

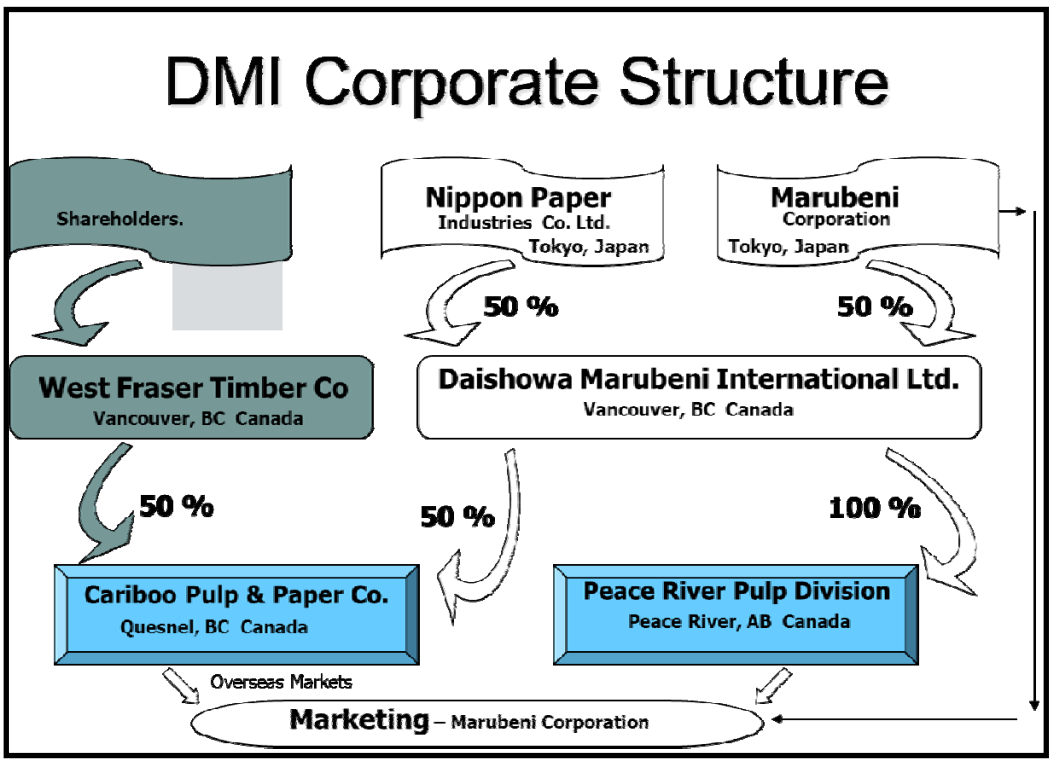


Figure 1. Corporate structure of Peace River Pulp Division.

DMI operates a bleached Kraft pulp mill at a site 25km north of the Town of

Peace River Alberta. The mill produces approximately 470,000 air dried metric tonnes per year of premium quality hardwood Kraft pulp and northern bleached softwood Kraft pulp. The mill directly employs approximately 300 full time staff.

DMI obtains its hardwood fibre primarily from Crown tenures but sources some from private purchase and residual sawmill byproducts. The furnish for softwood pulp production comes mainly from local softwood sawmill residual byproducts. While it has not historically been a large component of total softwood furnish, DMI has the capacity to produce softwood chips from softwood round wood through its in-bush chipping operations.

FMA0900045, represents roughly one quarter of DMI's future hardwood supply.

2.2 Canfor

Canfor Corporation is one of Canada's largest lumber producers with many operations in western Canada. The Grande Prairie Sawmill operation holds a coniferous timber quota on the affected FMA area. Conifer produced on the FMA0900045 area is primarily milled at the Grande Prairie operation.

See http://www.canfor.com/

2.3 Zavisha Sawmills Ltd.

Zavisha Sawmills Ltd is a family owned and operated sawmill located in Hines Creek Alberta. Zavisha holds a coniferous timber quota on the affected FMA area. The conifer produced in FMA0900045 is Zavisha's primary source of mill furnish with additional softwood coming from permits and private purchases.

2.4 Tolko – High Level Lumber Division

Tolko corporation is a large B.C. based company with many forest products operations in western Canada. It operates the High Level Lumber Division sawmill in High Level Alberta. The High Level sawmill holds a coniferous timber quota in what was previously the P10 FMU (now VSA1). The conifer produced by Tolko in FMA 0900045 is primarily used at the High Level sawmill.

See http://www.tolko.com/

3: Values, Objectives, Indicators, and Targets

The Alberta Planning Standard v4.1 April 2006 is structured on the CSA Z809-02 Sustainable Forest Management Certification. Specifically, the planning standard established (in Annex 4) a mandatory list of Values, Objectives, Indicators, and Targets that DFMPs must address.

DMI, Canfor, and Tolko all hold CSA Z809 certifications and this new DFMP is integral in maintaining those certifications. The actual CSA certification process enforces a much more rigid interpretation of the VOITs than what is expected from Alberta SRD. In many instances, Alberta is seeking a commitment to action. CSA certification auditors do not accept a commitment to action as meeting the requirements of a performance standard. Consequently, the certified company must either exceed the Alberta expectation or not include that VOIT in the CSA list of VOITs. Both examples are present in this plan.

The minimum government VOITs are 100% covered and explained in this document. The voluntary VOITs used for CSA certification are also presented here to simplify documentation and to avoid confusion of the public advisory members. The voluntary VOITs are presented here for information purposes only – they are not here for government approval. If certification requirements change during the life of this plan, the voluntary VOITs will be added to or dropped without compromising the approval of this plan.

3.1 VOIT Table

Table 1 is a formatted version of the Alberta planning standard Annex 4 VOIT table of minimum VOITs. All items are addressed. The column on the right side of the table references the detailed section describing particulars.

Table 1. Alberta Planning Standard VOIT Table. The column on the right side cross-references the Indicator(s) in subsequent sections that describes how that line item is addressed.

ASRD Planning Standard v4.1 April 2006						
CCFM Criteria	**CSA SFM Element**	**Value**	**Objective**	**Indicator**	**Target**	**DMI DFMP Indicator #**
1. Biological Diversity	1.1 Ecosystem Diversity	1.1.1 Landscape Scale Biodiversity	1.1.1.1 Maintain Covertype/Seral Stage Distribution	(a) Minimum area of old forest in gross landbase	Unspecified minimum	**2**
				(b) Minimum area of mature + old forest in gross landbase	Unspecified minimum	**2**
				(c) Maximum area of young forest in gross landbase	Unspecified maximum	**2**
				(d) Minimum area of old forest in net landbase	Unspecified minimum	**2**
				(e) Minimum area of mature + old forest in net landbase	Unspecified minimum	**2**
				(f) Maximum area of young forest in net landbase	Unspecified maximum	**2**
			1.1.1.2 Avoid Landscape Fragmentation	(a) Patch Size Distribution of Harvested Stands	200 year patch size pattern will approximate natural disturbance	**4,5**
				(b) Area of Old Interior Forest by Cover Class	Unspecified minimum over 200 years	**6**
			1.1.1.3 Minimize Access	(a) Open all-weather forestry road density by subunit	Unspecified maximum by subunit	**C1**
				(b) Open Seasonal / Temporary forestry road length by DFA	Unspecified maximum by subunit	**C2**
			1.1.1.4 Maintain plant communities uncommon in DFA or province	Area or occurrence of each uncommon plant community within DFA	Unspecified % of each identified plant species' community will be maintained	**C3**
			1.1.1.5 Maintain unique habitats created by wildfire and blowdown events	(a) Area of unsalvaged burned forest	(a) Retain all live unburned green tree islands and patches recognizing timber condition, access, and non-timber needs	**C4**
					(b) Compartment Scale: retain more than 10% of merchantable burned black trees in patches greater than 100ha	**C4**
					(c)Harvest Area Scale: Retain 10% of merchantable burned black trees in patches 10-100ha	**C4**
					(d) Harvest Area Scale: Retain 5% of merchantable burned black trees in small patches and single stems according to loggers choice	**C4**
				(b) Area of unsalvaged blowdown	Unspecified area of unsalvaged timber to be left in areas of significant blowdown.	**C5**
			1.1.1.6 Retain ecological values and functions associated with riparian zones	Operating ground rule compliance	Consistent with OGR	**C6**
		1.1.2 Local / Stand scale biodiversity	1.1.2.1 Retain Stand Level Structure	(a) %area / %volume stems residual structure within harvested area representative of the staus (live/dead) sizes, and species of overstory trees by subunit and DFA.	Unspecified Minimum	**7**
				(b) % of harvested area by subunit with downed woody debris equivalent to preharvest conditions	Unspecified Minimum	**8**
			1.1.2.2 Maintain integrity of sensitive sites	Sensitive sites by subunit and DFA	Strategies consistent with OGR	**11,12,14,21**
			1.1.2.3 Maintain aquatic biodiversity by minimizing impacts of water crossings.	# Crossings in compliance with Code of Practice by subunit	Designs meet standards for Code of Practice for Water Course Crossings	**33,34,36**
	1.2 Species Diversity. Conserve species diversity by ensuring that habitats for DFA native species are maintained throughout time.	1.2.1 Viable populations of plant and animal species	1.2.1.1 Maintain habitat for identified high value species.	Area of suitable habitat OR Specific population parameters	Unspecified Minimum area of suitable habitat OR Unspecified trends in population parameters	**9,10,11,12**
	1.3 Genetic Diversity Conserve genetic diversity by maintaining the variation of genes within species	1.3.1 Genetic integrity of natural tree populations	1.3.1.1 Retain wild forest populations for each tree species in each seed zone through establishment of in-situ reserves	Number and area of in situ genetic conservation sites	Unspecified Minimum	**17**
			1.3.1.2 Retain wild forest genetic resources through ex-situ conservation	Number of provenances and genetic lines in ex-situ gene banks and trials	Active conservation program in place for controlled parentage plan species and other species	**18**
	1.4 Protected Areas - Respect protected areas identified through government processes.	1.4.1 Areas with minimal human disturbances within managed landscapes	1.4.1.1 Integrate transboundary values and objectives into forest management	Stakeholder consultation	Ongoing consultation with relevant protected areas agencies	**20**

Continued on next page…

Table 1 Continued .

ASRD Planning Standard v4.1 April 2006						
CCFM Criteria	**CSA SFM Element**	**Value**	**Objective**	**Indicator**	**Target**	**DMI DFMP Indicator #**
2. Ecosystem Productivity	2.1 Ecosystem Resilience	2.1.1 Reforested Harvest Areas	2.1.1.1 Meet reforestation targets on all harvested areas	Annual % Satisfactorily Restocked Regeneration Surveys.	Set target based on TSA	**23**
				Cumulative % of reforested areas that meet reforestation targets	Set target based on TSA	**23**
		2.1.2 Maintenance of Forest Landbase	2.1.2.1 Limit conversion of productive forest landbase to other uses.	Amount of change in forest landbase	A program to maintain the forest landbase	**25**
			2.1.2.2 Recognize lands affected by insects, disease, or natural calamities	Amount of area affected	Area(ha) affected by significant outbreaks, infestations, natural calamities	**22**
		2.1.3 Control Invasive Species	2.1.3.1 Control non-native plant species (weeds)	Noxious weed program	Noxious weed program in place and implemented	**C7**
3. Soil & Water	3.1 Soil Quantity and Quality	3.1.1 Soil Productivity	3.1.1.1 Minimize impact of roading and bared areas in forest operations	Compliance with OGRs	Less than 5%	**29, 31**
			3.1.1.2 Minimize incidence of soil erosion and slumping	Incidence of soil eriosion and slumping	Complete compliance	**28, 30, 38**
	3.2 Water Quantity and Quality	3.2.1 Water Quantity	3.2.1.1 Limit impact of timber harvesting on water yield	Forecast impact of timber harvesting on water yield	Zero water act penalties; Complete compliance with FMP	**39**
		3.2.2 Effective Riparian Habitats	3.2.2.1 Minimize impact of operations in riparian areas	Riparian buffers maintained as outlined in OGRs	Complete Compliance	**37,36, 33, 32,**
4. Global Ecological Cycles	4.1 Carbon Uptake and Storage	to be determined	to be determined	Results of carbon budget modeling	to be determined	**40**
	4.2 Forest Land Conversion	see 2.1.2 above				**25**
5. Multiple Benefits to Society	5.1 Timber and Non-Timber Benefits	5.1.1 Sustainable Timber Supplies	5.1.1.1 Establish appropriate AACs	Meet Planning Standards Annex 1 requirements	Complete Compliance	**26, 41**
	5.2 Communities and Sustainability	5.2.1 Low Wildfire Risk	5.2.1.1 Reduce Wildfire Threat Potential	a) % Reduction in hectares of extreme and high fire behaviour potential in FireSmart Community Zone	Unspecified % reduction	**C8**
				b) % Reduction in hectares of extreme and high fire behaviour potential on the DFA	Unspecified % reduction	**C8**
		5.2.2 Provide opportunities to derive benefits / participate in use & management	5.2.2.1 Integrate other uses and timber management activities	Extent of various uses	Unspecified	**42**
		5.2.3 Forest Productivity	5.2.3.1 Maintain Long Run Sustained Yield Average	Regenerated stand productivity	>= Natural stand productivity	**44**
6. Accepting society's responsibility for sustainable development	6.1 Aboriginal and treaty rights and aboriginal forest values	6.1.1 Compliance with government regulations and policies	6.1.1.1 Implement Public Involvement Program	Meet Alberta's unspecified expectation - Consult at community level	Unspecified	**C9**
	6.2 Public participation	6.2.1 Meaningful public Involvement	6.2.1.1 Implement Public Involvement Program	Meet expectations of CSA Z809-02	Unspecified	**C10**

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4: DMI Detailed Indicator Descriptions

The indicators described here represent the full suite of indicators tracked by DMI for CSA Z809 certification. Voluntary Indicators used for certification but not specifically requested in the Alberta Annex 4 table are clearly denoted.

4.1 Indicator 1: Gross Landbase for Forest Cover Classes by Natural Subregion

This is a voluntary CSA Indicator for CSA Z809-08.

What does this indicator mean?

WHAT ARE THE ECOSYSTEMS AFFECTED BY THIS PLAN?

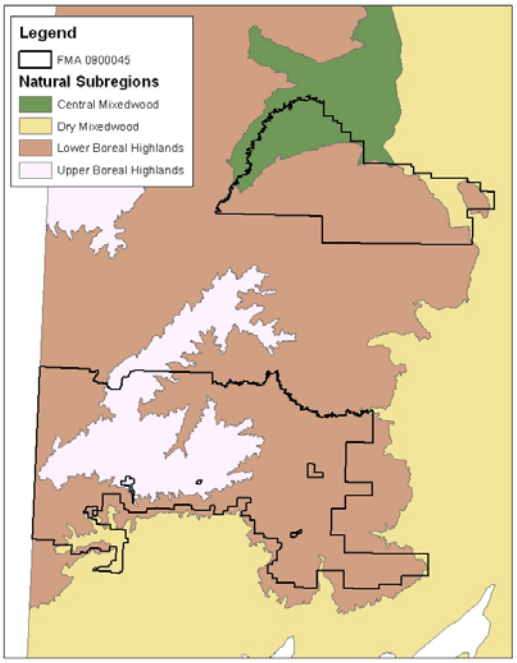


Figure 1-1. Natural SubRegions in FMAWest

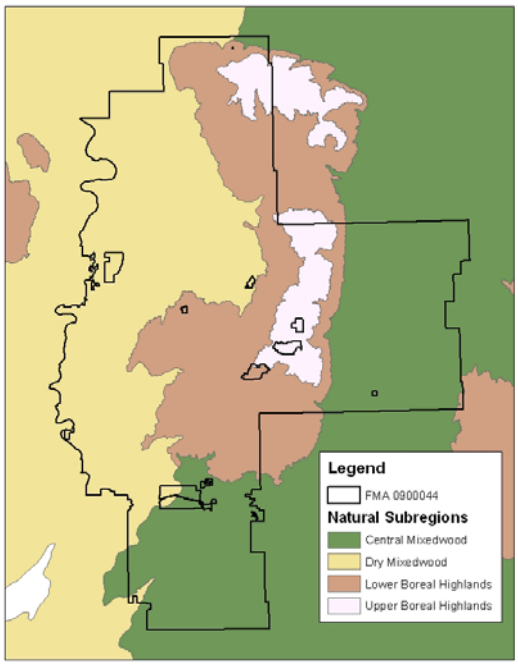


Figure 1-2. Natural Subregions in FMA East

What Is the Allowed Variance From the Target?

Allowed Variance is set at 0. The natural forest changes by itself. Climate change, forest fires, insect outbreaks and other natural events will cause variations from the targets established based on the 2009 forest state.

What Happens If Allowed Variance is Exceeded?

Variance from target will be assessed during next DFMP preparation. Inventory changes and natural processes will lead to changes. New forest management strategies will determine acceptable conditions.

Target:

2009-level (inventory measure)

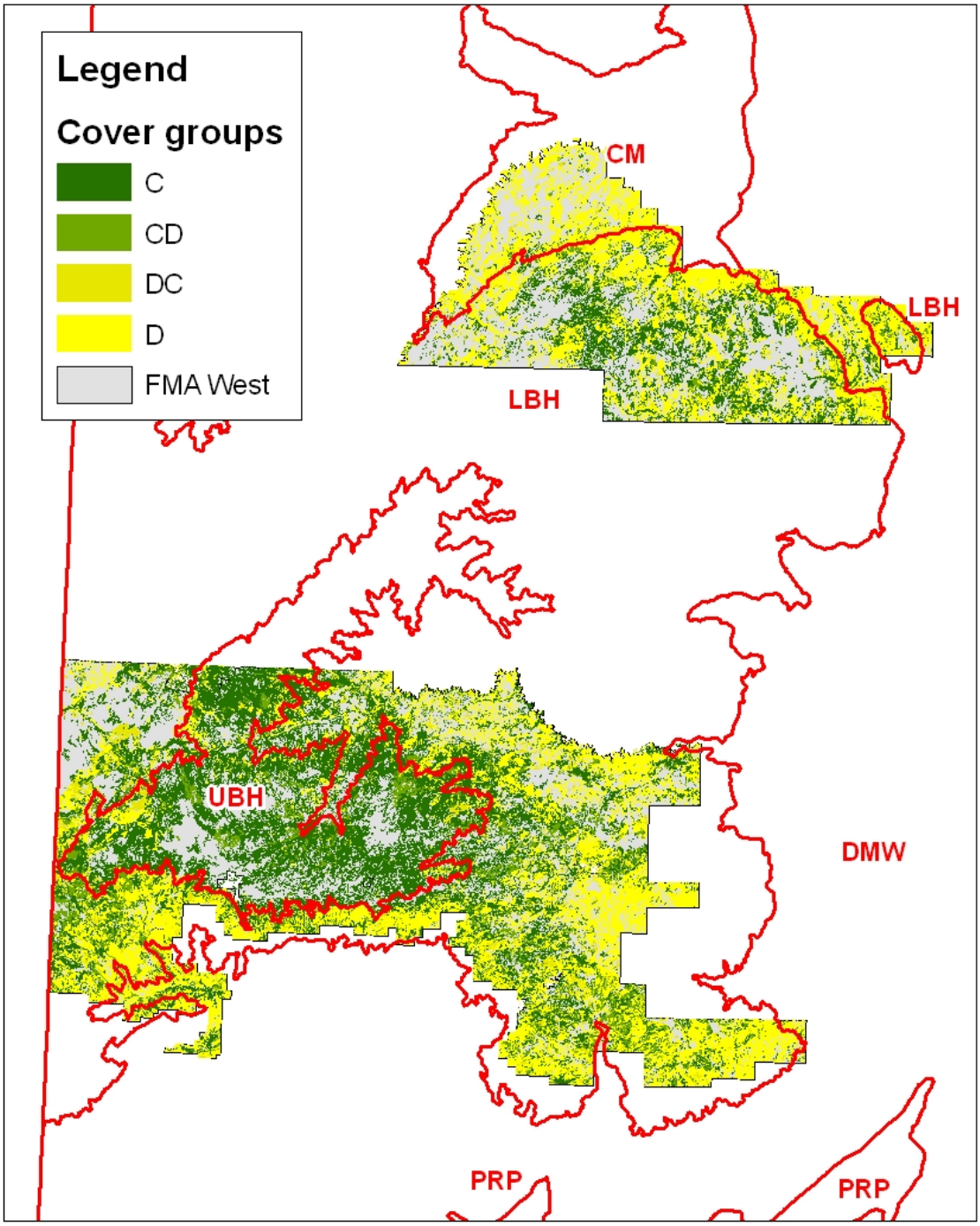
Current Status and Forecasted Targets/Thresholds of Indicator

Current Status = Target for next 10 years:

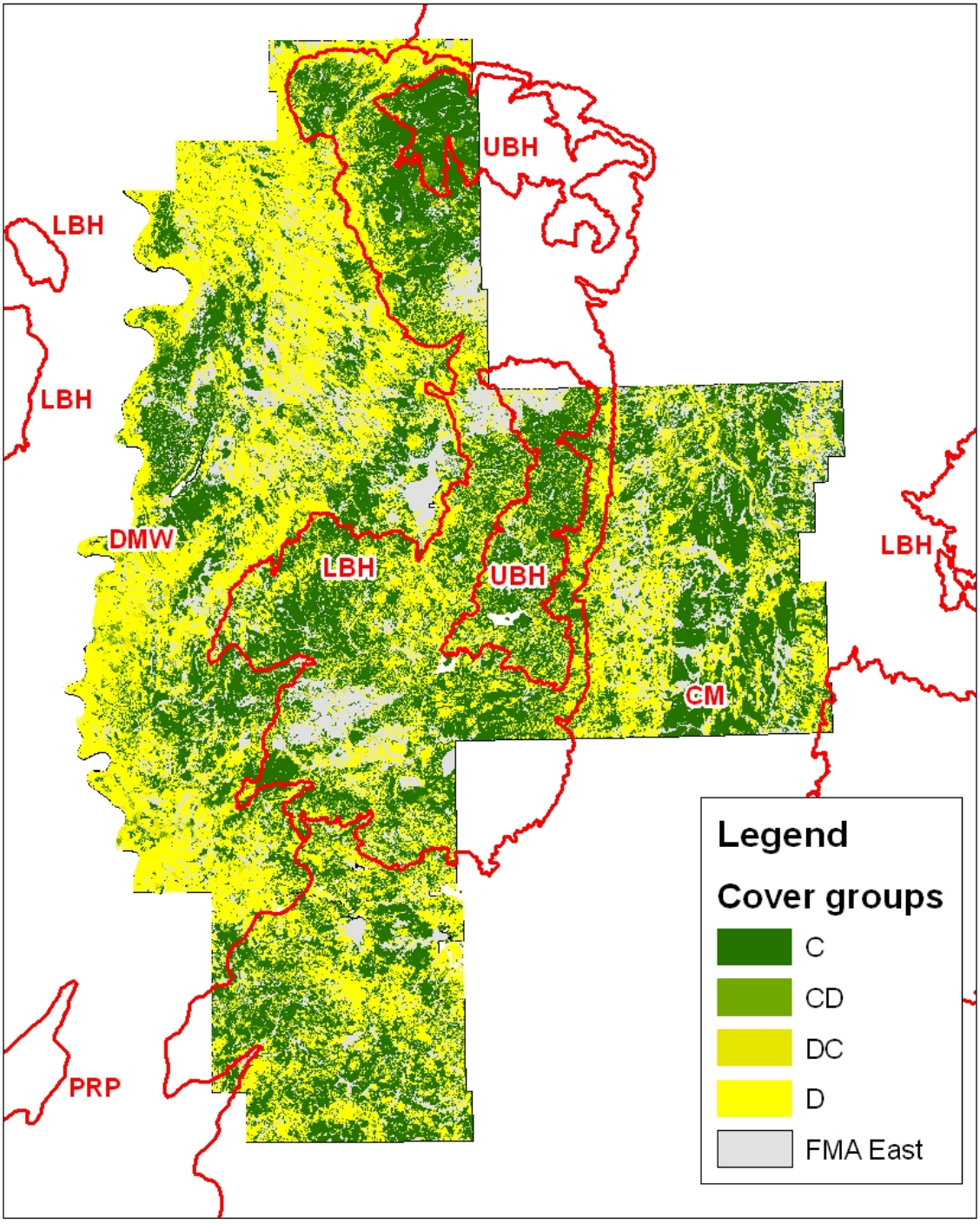
FMA West				
Broad Cover Group (BCG)	Natural Subregion			
	Central Mixedwood (CMW)	Dry Mixedwood (DMW)	Lower Boreal Highlands (LBH)	Upper Boreal Highlands (UBH)
D	28284	24528	221524	12945
DC	1317	2354	39110	5612
CD	1132	2856	53044	14820
C	1653	5800	157713	107088
FMA East				
Broad Cover Group (BCG)	Natural Subregion			
	Central Mixedwood (CMW)	Dry Mixedwood (DMW)	Lower Boreal Highlands (LBH)	Upper Boreal Highlands (UBH)

D	169953	306267	143021	16291
DC	20527	24651	18273	5774
CD	13520	17828	14576	4697
C	237144	167627	208131	65837

Cover Groups by Natural Subregion



Cover Groups by Natural Subregion



Rationale for variance:

This is a baseline establishment and not an update – therefore there is no variance at this time.

Indicator Monitoring Plans

This indicator is measured and reported on during DFMP preparation. This will be done once every ten years. Adjustments to targets and/or change in actions to achieve targets are carried out by implementing subsequent plans.

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Review Status and report	Update Inventory	DMI	2017 in time for DFMP2019

4.2 Indicator 2: Net Landbase Area by Cover group/Seral Stage at future points in time

This Indicator meets Alberta Objective 1.1.1.1 a) b) c) d) e) f).

What does this indicator mean?

ARE ALL HABITATS MAINTAINED OVER TIME?

This indicator tracks the area distribution of old and mature forest types over time. Conifer dominated areas and deciduous dominated areas are broken out by FMA. The numbers show how much old habitat is going to be present at future points in time

TARGET:

Targets are based on natural range of variation and have been vetted through.DFMP planning process.

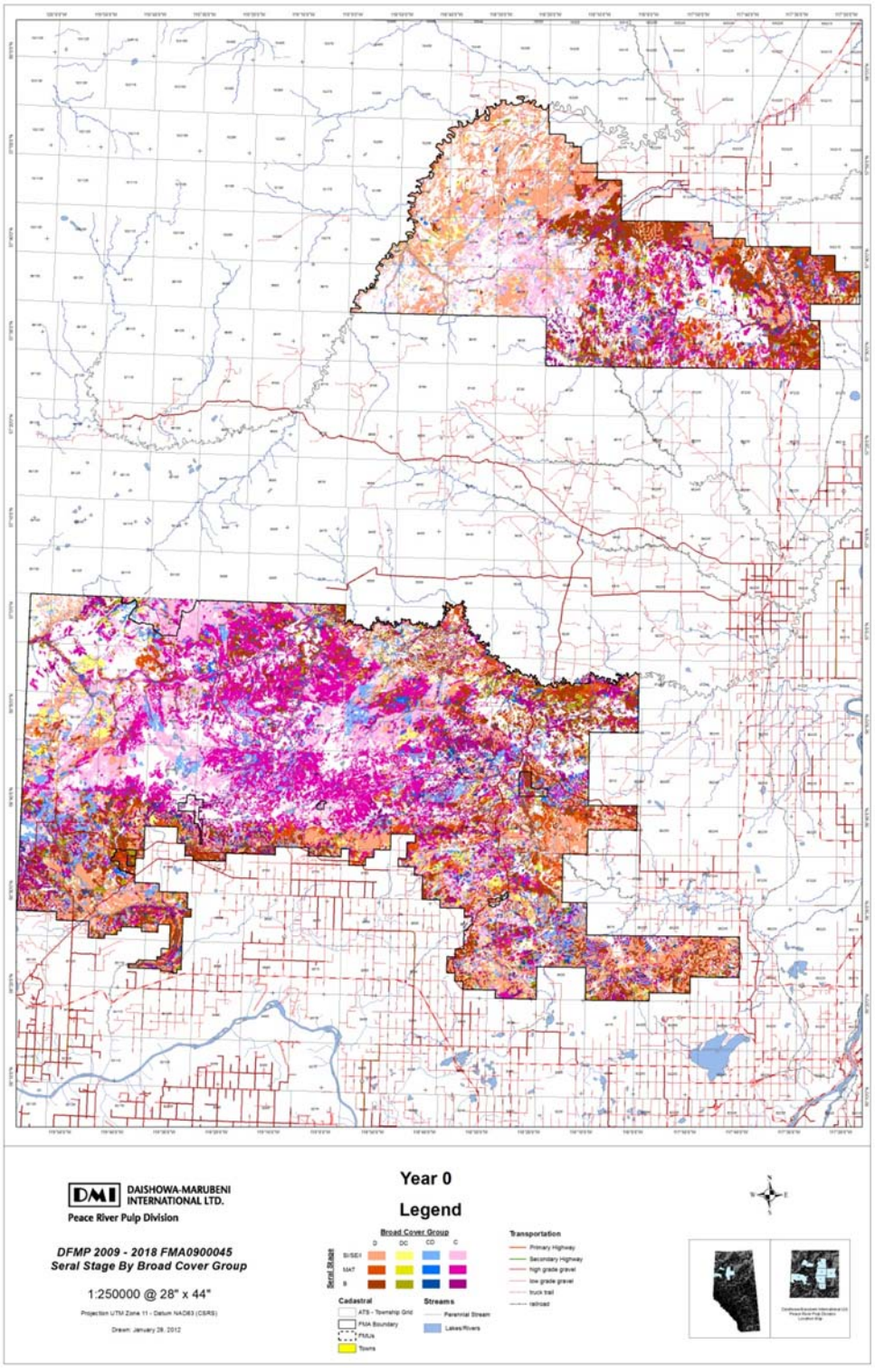
Table 2. Target Seral Stage/Covergroup combinations used in preferred harvest scenario.

Strata	FMU P19
Mature Conifer	17,692
'Breakup' Conifer	28,116
Mature Deciduous	28,522
'Breakup' Deciduous	40,120
'Old' Empirical Strata	53,910

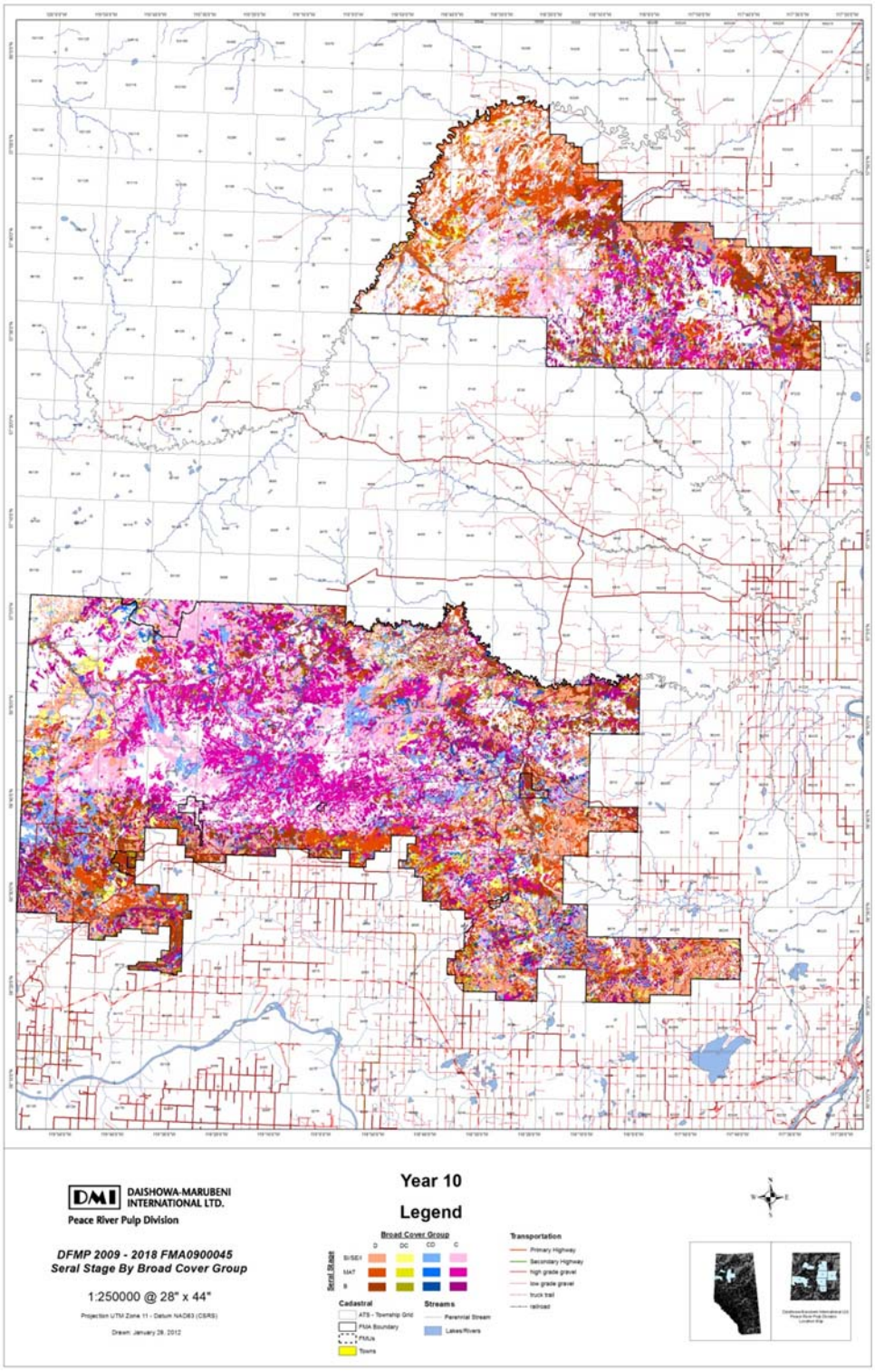
Current Status and Forecasted State of Indicator

Table 3. West FMA Preferred Harvest Sequence Forecast Target Indicator

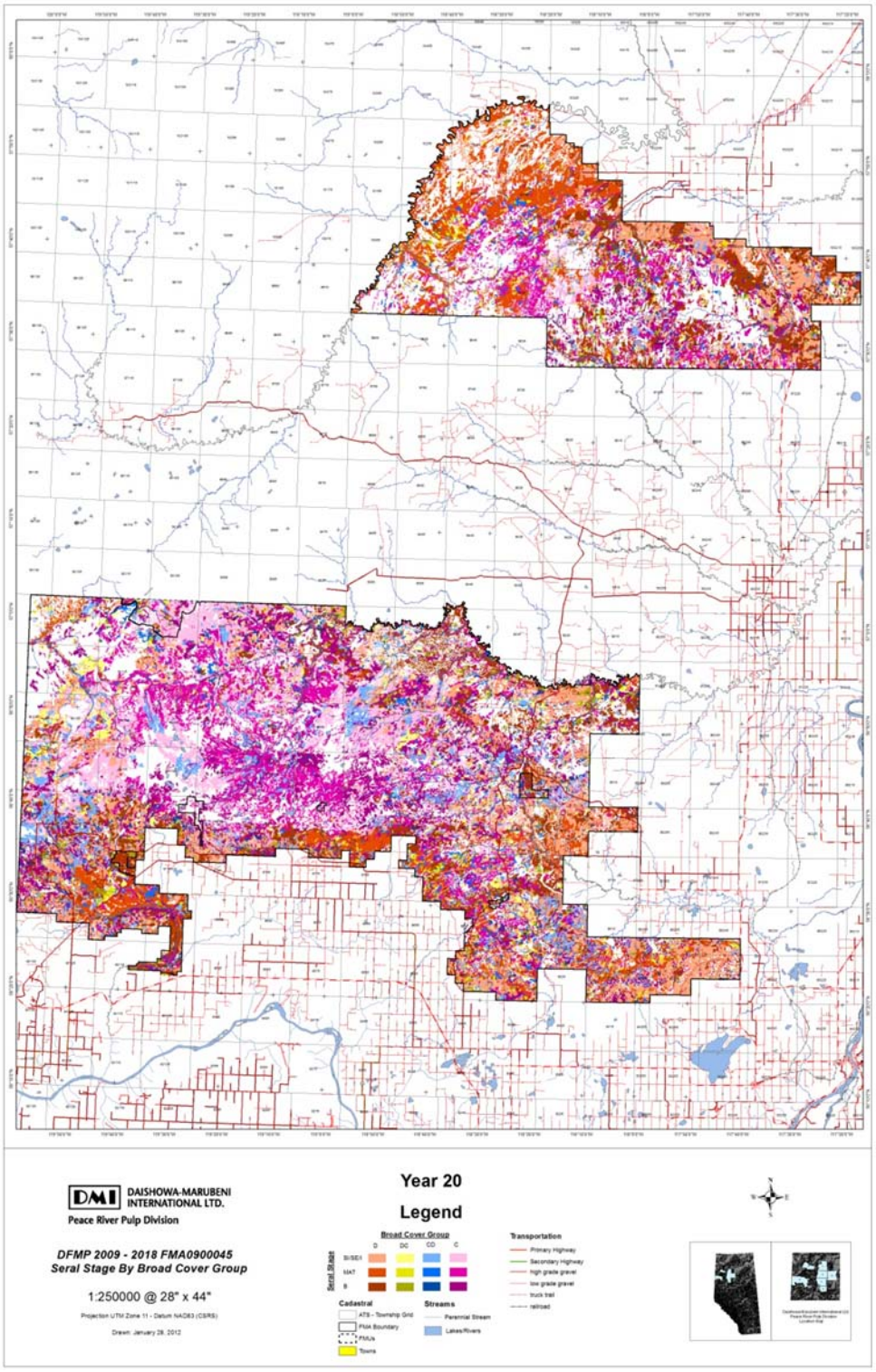
SYU	Yield Strata	Cover Group	Seral Stage	Years from Start Date 0	10	50	100	200
P19	Successional	D/DC	MAT	37,223	65,349	22,200	46,206	38,676
			B	101,435	92,013	49,769	20,060	40,120
		C/CD	MAT	35,363	28,825	10,266	26,480	17,692
			B	30,485	38,109	24,813	14,058	28,116
	Empirical		Old	68,134	49,338	49,527	32,506	53,910



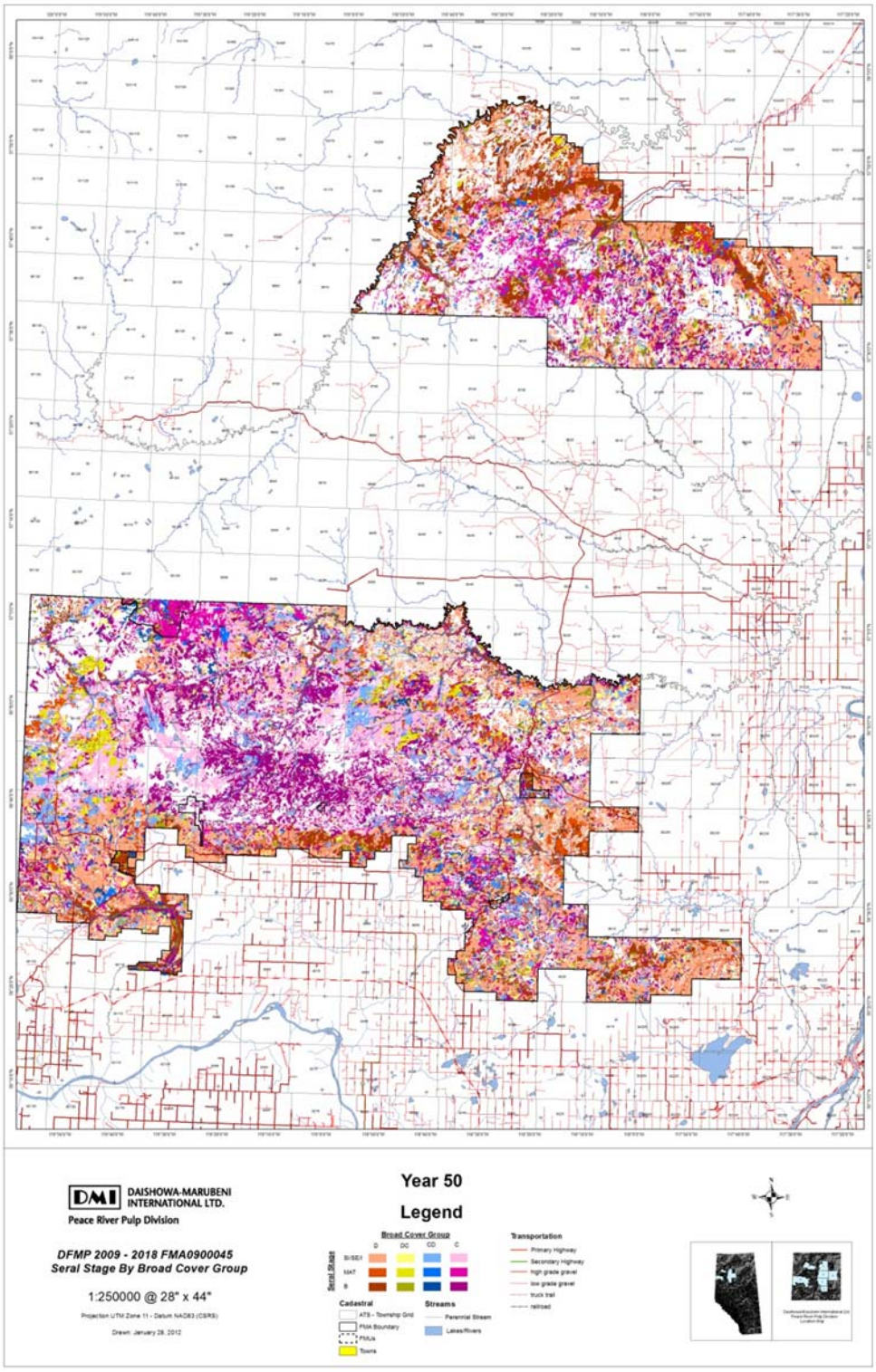
Map 1. Seral Stage by Broad CoverGroup Forecast for 2009.



Map 2. Seral Stage by Broad Cover Group Forecast for 2019.



Map 3. Seral Stage by Broad Cover Group Forecast for 2029.



Map 4. Seral Stage by Broad Cover Group Forecast for 2059.

Rationale for variance:

This is a baseline establishment and not an update – therefore there is no

variance at this time.

Indicator Monitoring Plans

DMI will update and report every 5 years in the stewardship report.

4.3 Indicator 3: Cut Block Shape Index distribution by company

This is a voluntary CSA Indicator.

What does this indicator mean?

ARE THE CUTBLOCK SHAPES NATURAL & VARIABLE?

This indicator shows whether or not companies are harvesting blocks of different shapes.

It is important in ecosystem management to maintain natural forest shape and arrangement. If harvests are performed using natural shape and size combinations, it is more likely that the forest will maintain natural biodiversity.

The forest companies on this DFA have all adopted 'type cutting' where cutblocks' boundaries follow natural stand boundaries. The theory is that by doing this, the forest will maintain a natural arrangement over time.

This indicator will show that harvest blocks are of variable shapes.

What is the Allowed Variance from the target?

None.

What Happens if Allowed Variance is Exceeded?

Address in the next DFMP in 2019.

TARGET

The natural forest stand shape distribution is categorized into 4 classes. The target is to have more than 20 ha of harvest (ie at least one cut block) in each of the shape classes during each five year period.

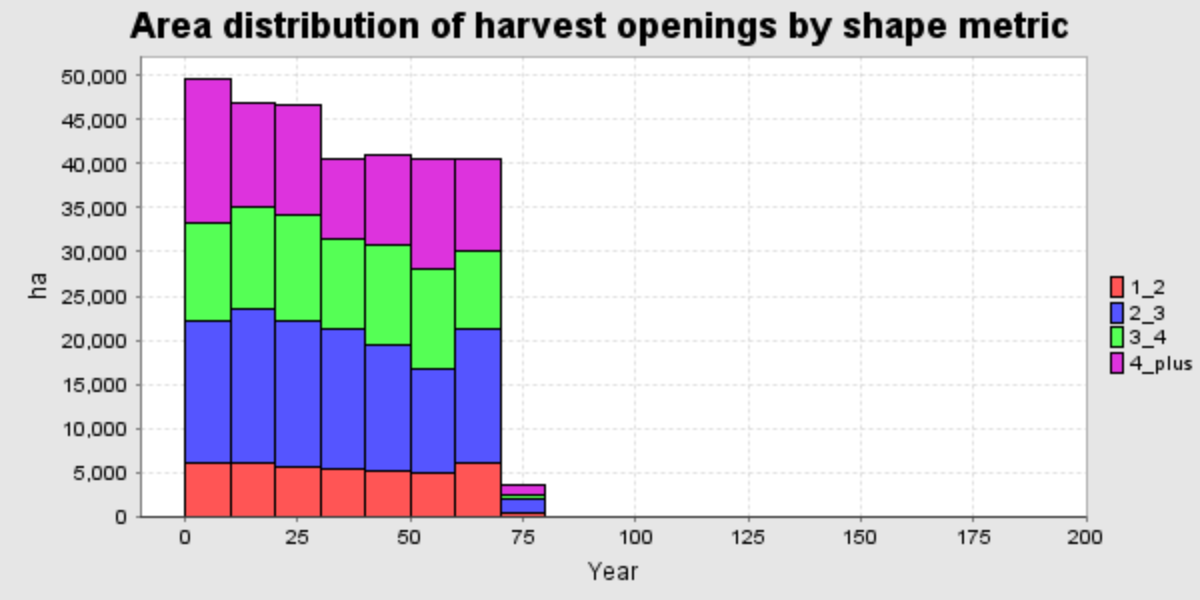


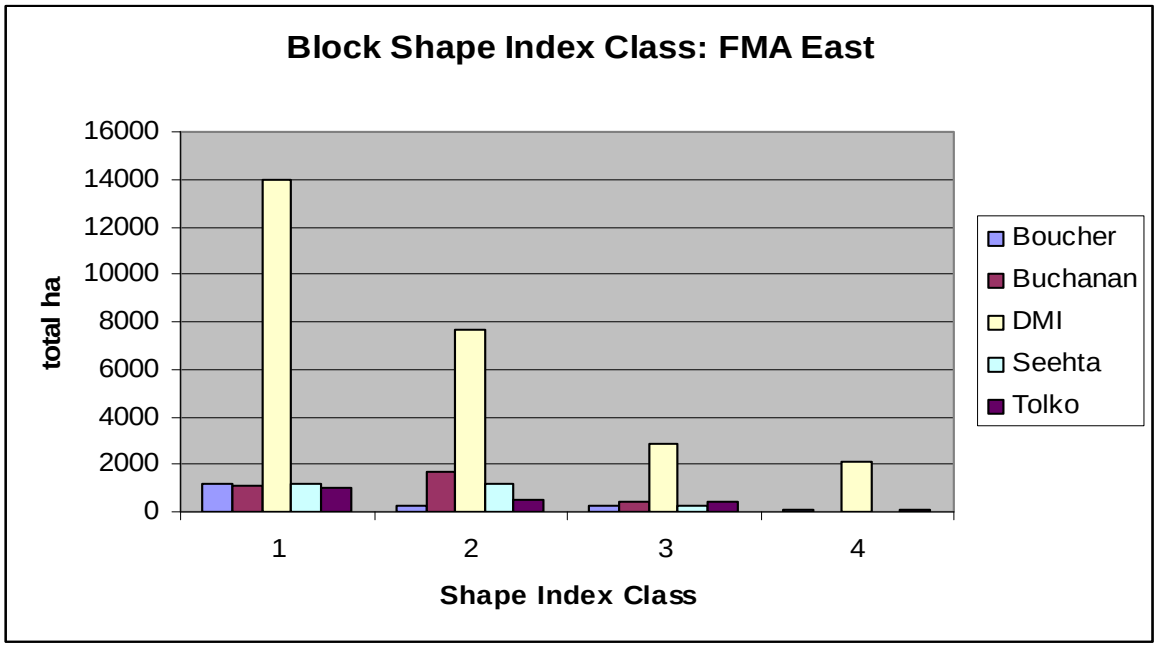
Figure 2. Target harvest block shape class distribution forecast by the Preferred Harvest Sequence.

Current Status and Forecasted Targets/Thresholds of Indicator

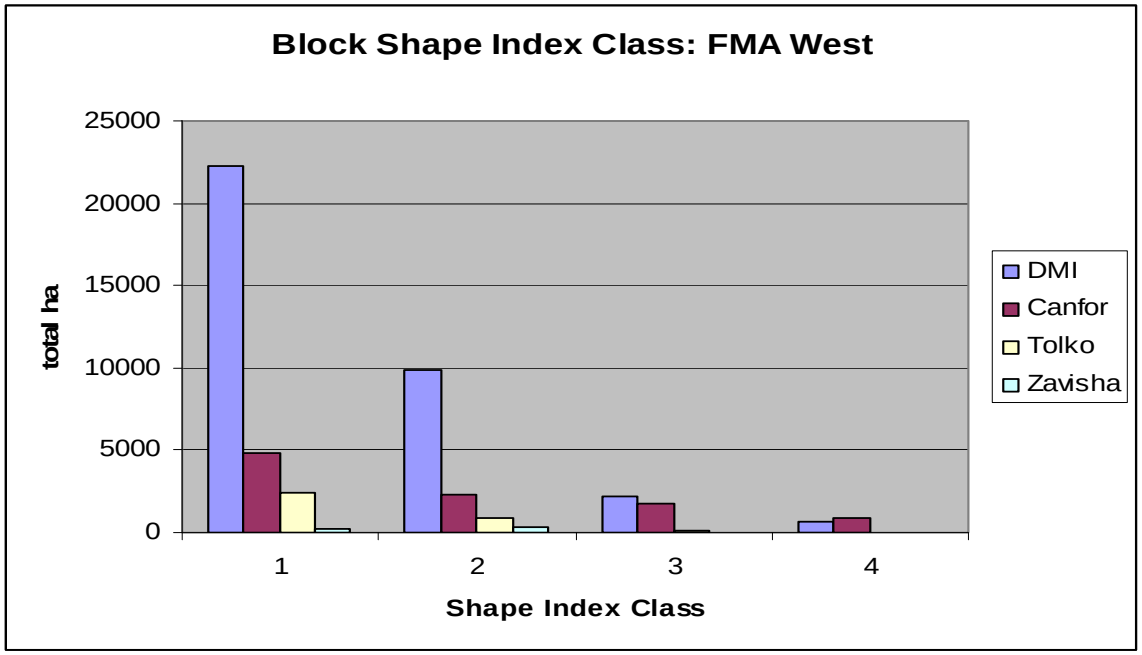
Current Status:

Shape Index was calculated for blocks harvested in 1989 or later within each FMA and was grouped by company, and the areas summed for each class. The following distribution of Shape Index Classes was derived:

FMA East



FMA West



Rationale for variance:

The current status presented shows 20 years of blocks. The type-cutting strategy is a recent adoption so the past distribution is somewhat different than the future will be.

There will be periods when an individual company will not encounter complex shape stands. This is evidenced here by the lack of category 4 harvest area for some companies.

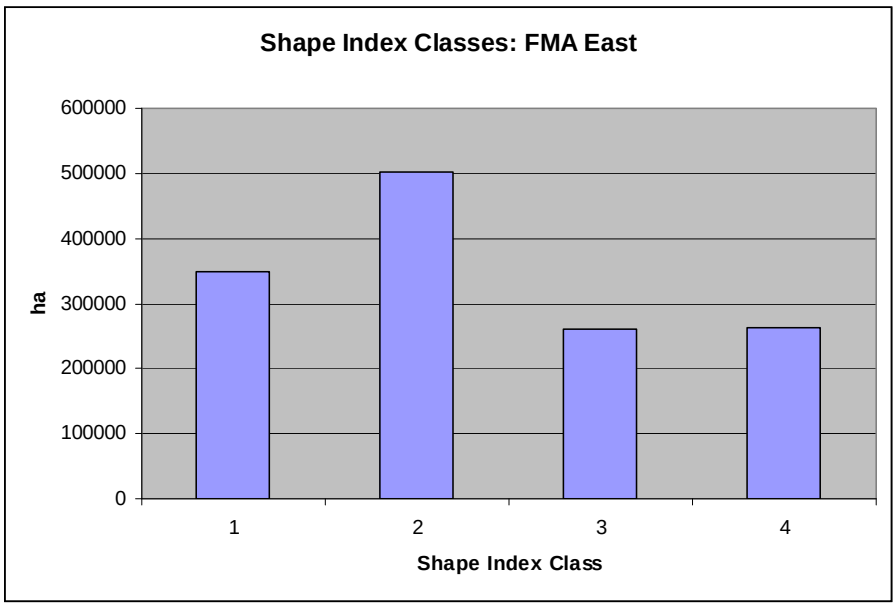


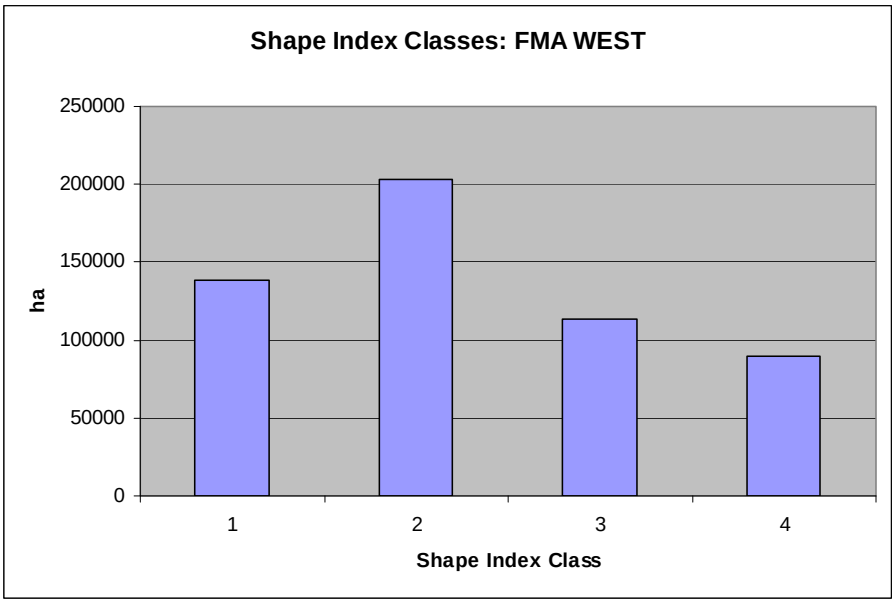
Figure 3 Simple shape (Shape Index = 1, left), and complex shape (Shape Index = 15, right)

Shape Index classes were calculated as follows:

[SHAPE_INDEX]	[SHAPE_INDEX_CLASS]
1.0 – 1.99	1
2.0 – 2.99	2
3.0 – 3.99	3
>= 4.0	4

The 2009 forest inventory (AVI) yields the following distribution of stand area by Shape





Indicator Monitoring Plans

The indicator will be compiled during the annual AVI depletions update and reported every 5th year in the Stewardship Report.

4.4 Indicator 4: Cut Block size distribution by company

This indicator meets the requirement of Alberta objective 1.1.1.2 a).

What does this indicator mean?

ARE OUR CUTBLOCK SIZES NATURAL & VARIABLE?

This indicator tracks the variability of sizes among second-growth forest stands regenerating from harvest blocks within one 10 year planning period.

It is reported as a range of patch sizes stratified by company per population of blocks within each 5-year period, to demonstrate the effort to maintain the variation in size that would occur among natural forest stands.

This target displays that harvest block sizes are variable.

What is the Allowed Variance from the target?

None.

What Happens if Allowed Variance is Exceeded?

Address in the next DFMP in 2019.

TARGET

Maintain variable harvest block sizes.

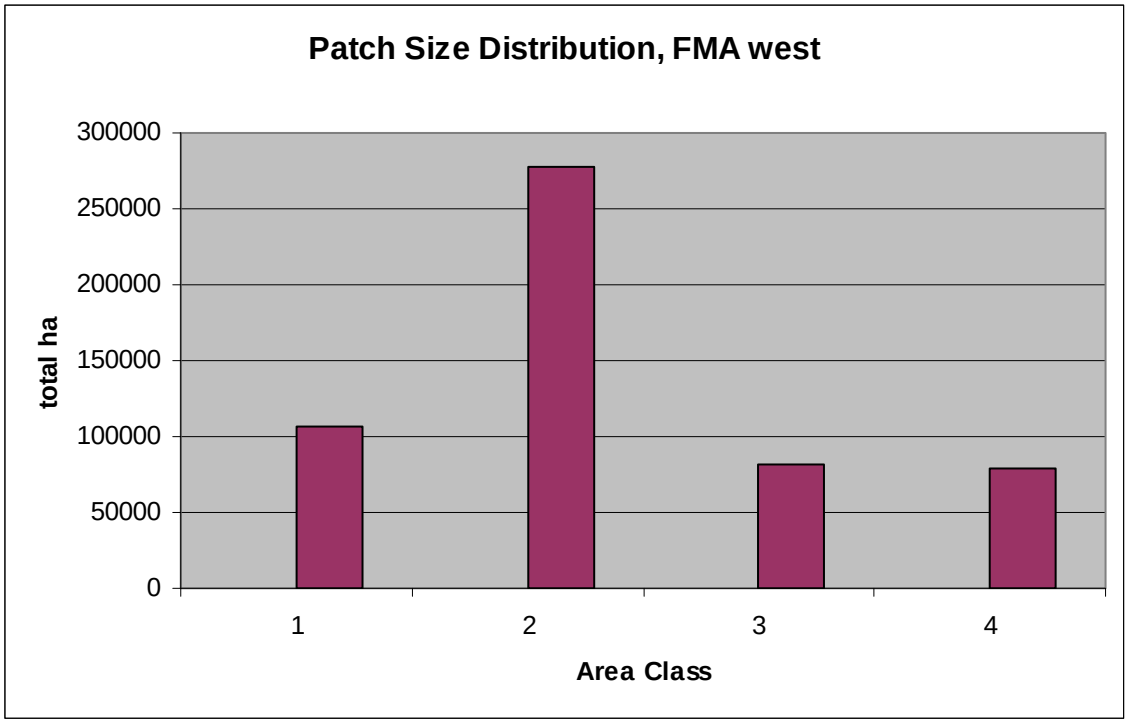
The natural forest stand size distribution will be categorized into 4 classes. The target is to have more than 20 ha of harvest (ie at least one cut block) in each of the size classes during each five year period.

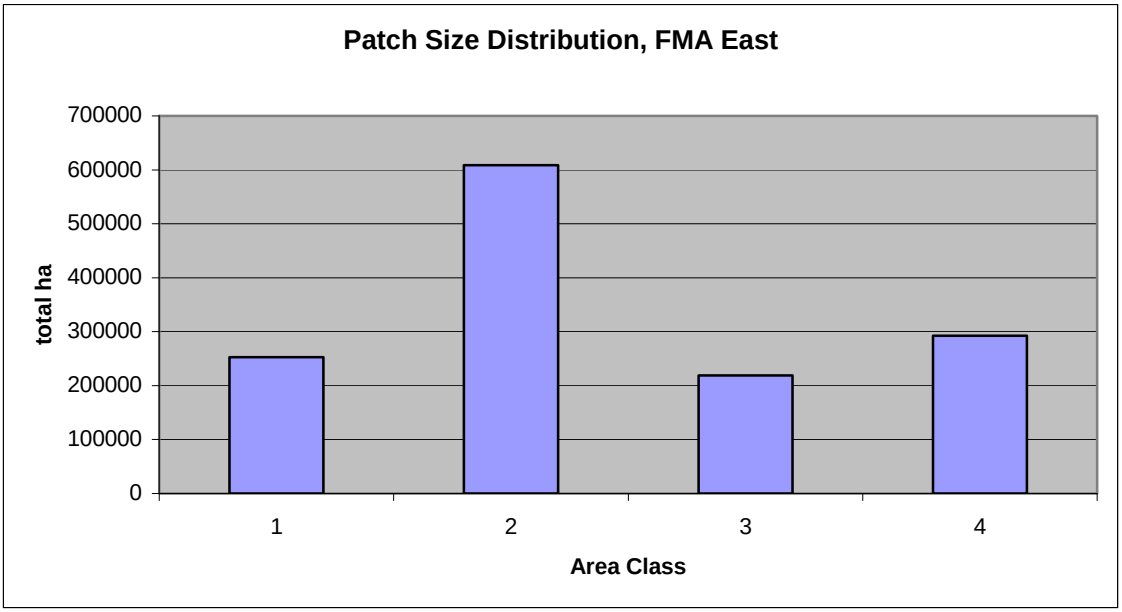
Current Status and Forecasted Targets/Thresholds of Indicator

Stand area classes were defined as follows:

AREA (ha)	AREA_CLASS
< 10	1
11 - 50	2
51 - 100	3
>100	4

As a baseline with which to compare block sizes, the 2009 forest inventory (AVI) yields the following distribution of forested stands by area class:

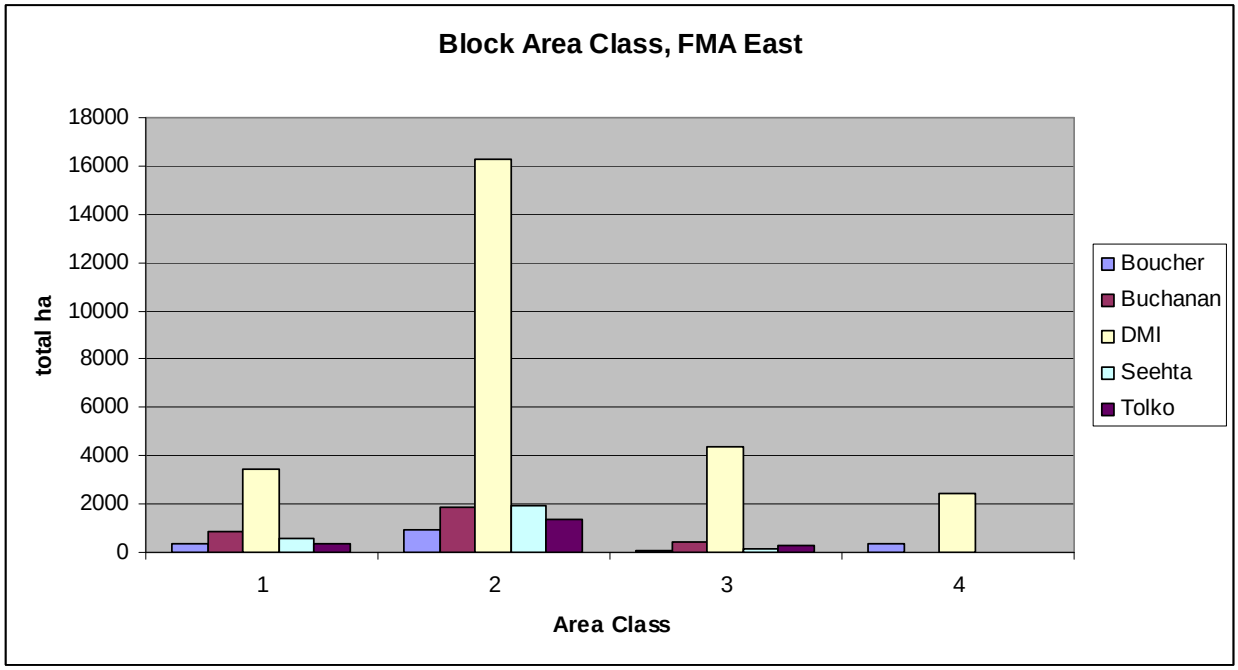




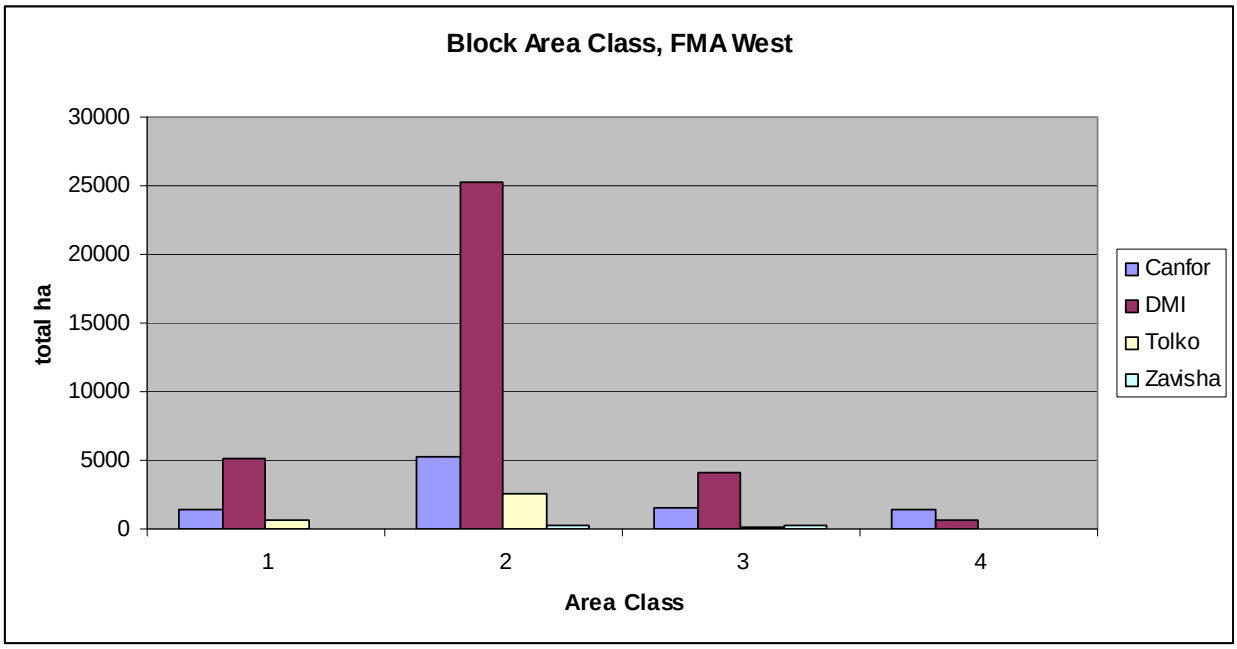
Current Status:

Blocks harvested in 1989 or later within each FMA were grouped by company, and the areas summed for each area class. The following distribution of area classes was derived:

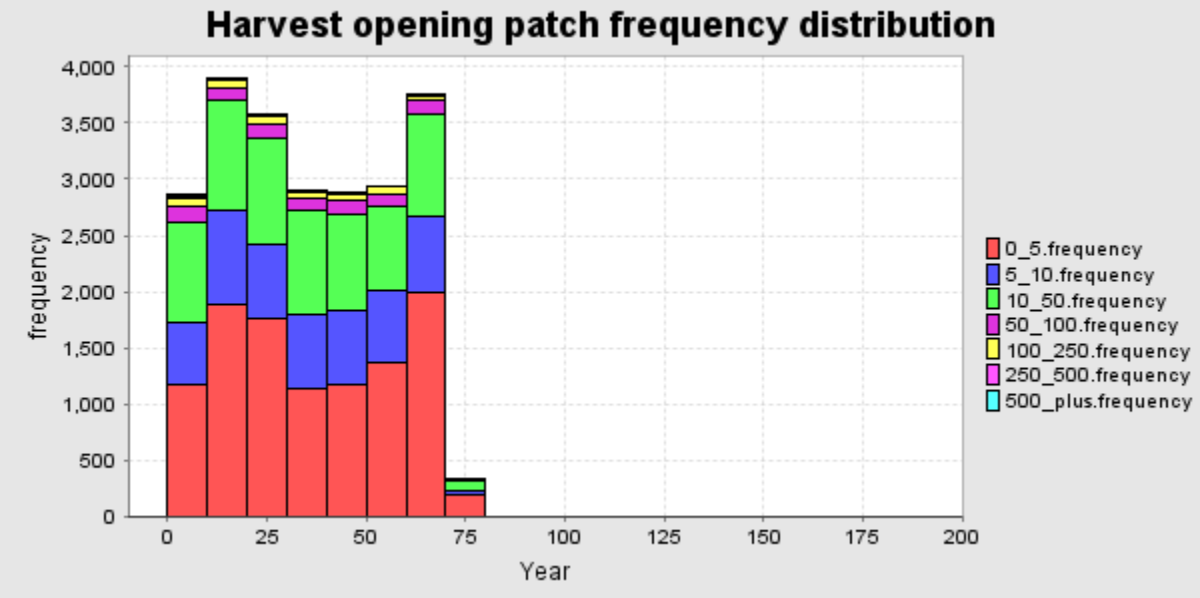
FMA east



FMA West


Block Area Class, FMA West
30000
25000
20000
15000
10000
5000
0
total ha
1
2
3
4
Area Class
Canfor
DMI
Tolko
Zavisha

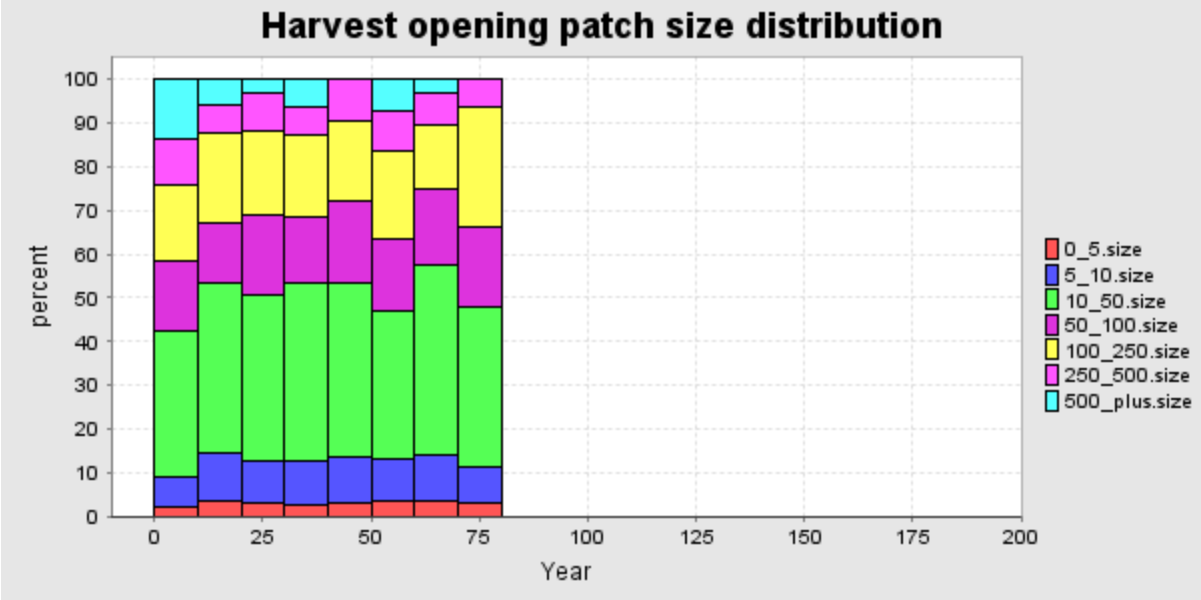
Forecast:



Openings are defined as the amount of contiguous area harvested within the same planning period.

Period	Year	patch.harvest							Total
		0_5	5_10	10_50	50_100	100_250	250_500	500_plus	
		frequency	frequency	frequency	frequency	frequency	frequency	frequency	
0	0	0	0	0	0	0	0	0	0
1	10	1,167	551	907	137	66	19	11	2,858
2	20	1,887	842	970	110	74	10	5	3,898
3	30	1,769	654	940	130	65	14	2	3,574
4	40	1,132	660	923	108	60	9	4	2,896
5	50	1,170	671	838	126	57	14	0	2,876
6	60	1,363	647	745	115	59	11	5	2,945
7	70	1,999	669	917	114	43	9	2	3,753

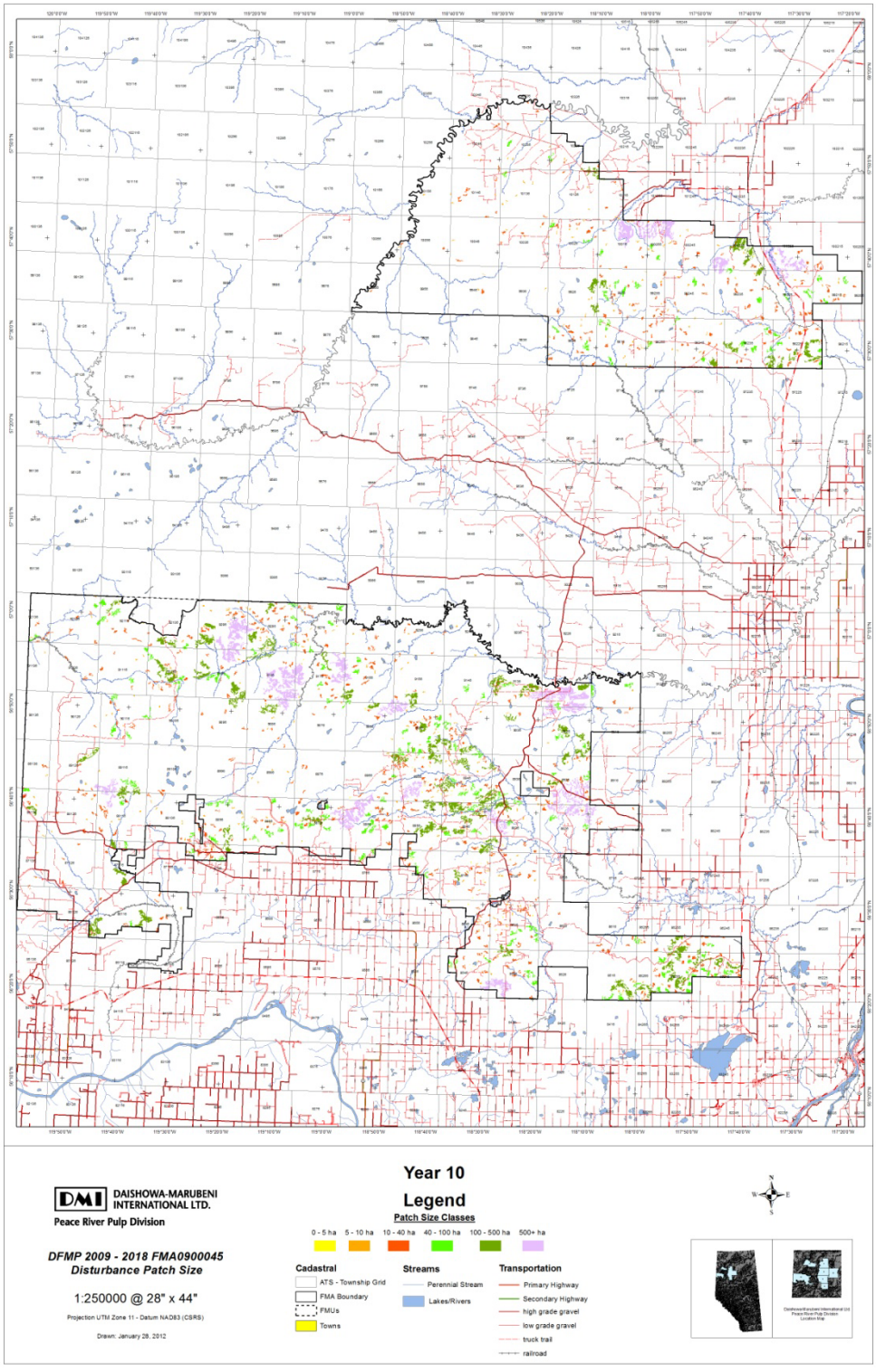
Figure 4. One Period Harvest Opening patch size frequency forecast.



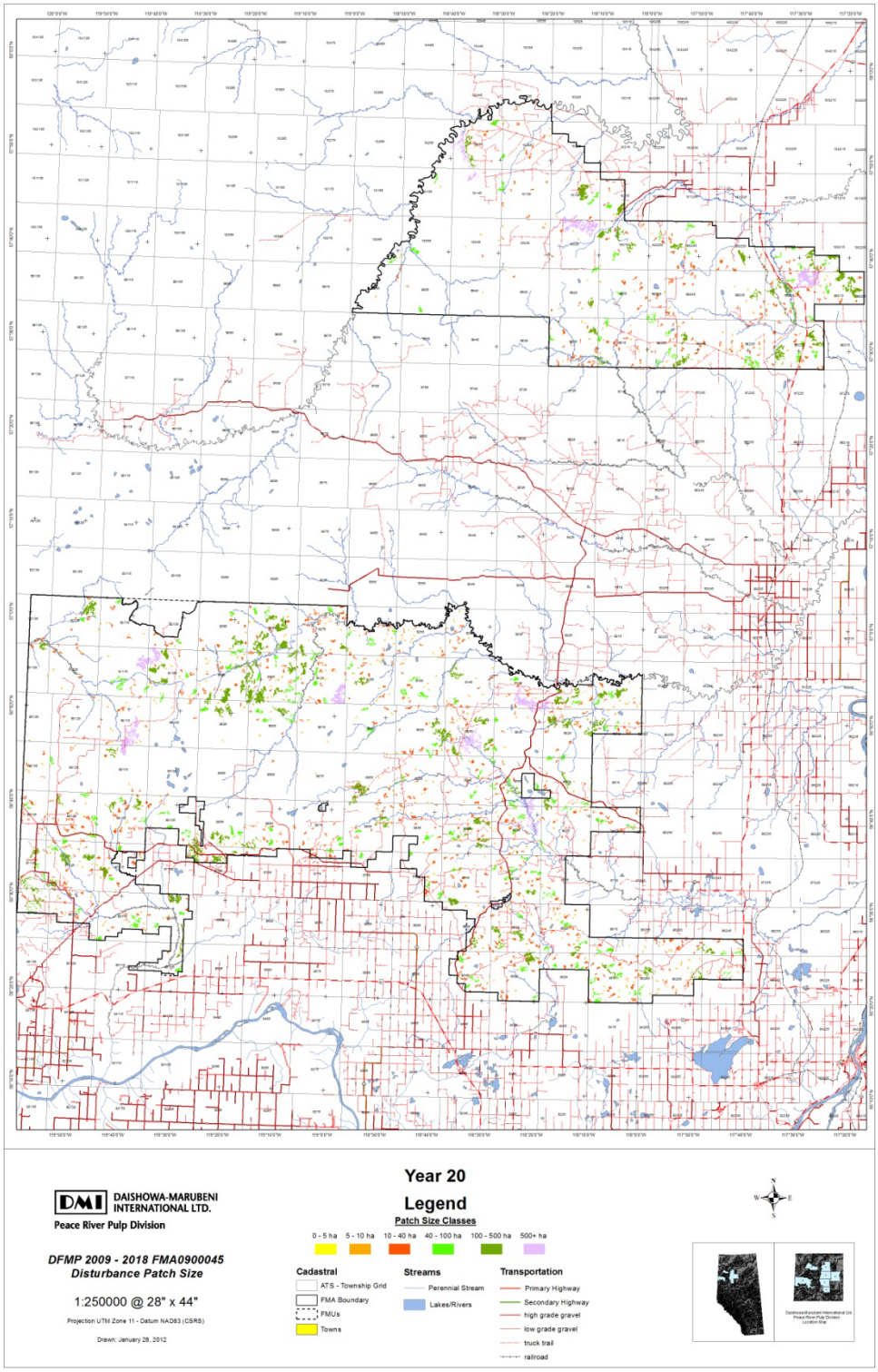
Openings are defined as the amount of contiguous area harvested within the same planning period.

Period	Year	patch.harvest							Total
		0_5 size	5_10 size	10_50 size	50_100 size	100_250 size	250_500 size	500_plus size	
0	0	0	0	0	0	0	0	0	0
1	10	2	7	33	16	17	11	14	100
2	20	3	11	39	14	21	6	6	100
3	30	3	9	38	18	19	9	3	100
4	40	3	10	41	15	19	6	6	100
5	50	3	10	40	19	18	10	0	100
6	60	3	10	34	17	20	9	7	100
7	70	3	11	43	17	15	7	3	100

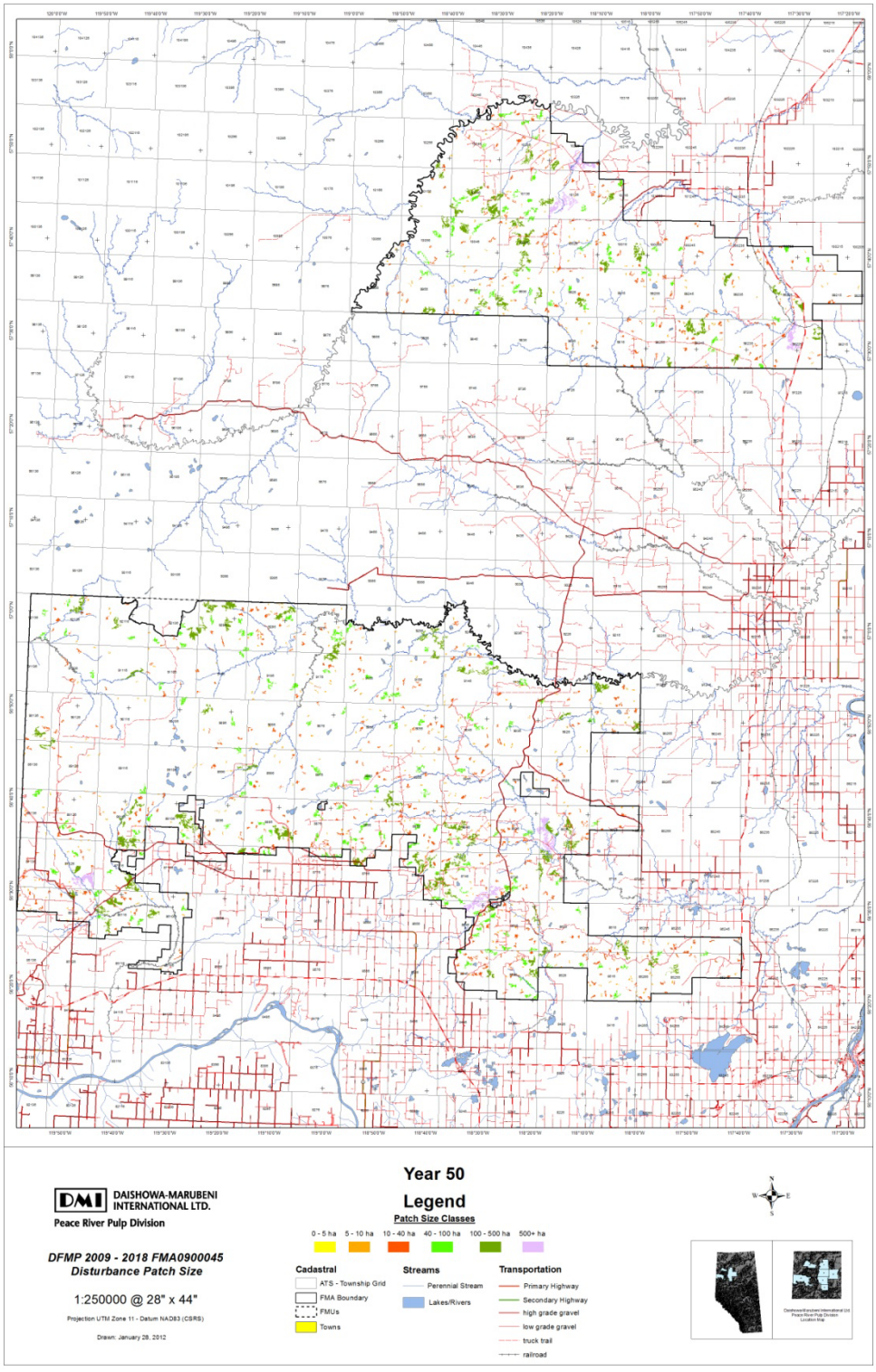
Figure 5. One Period Harvest opening patch size distribution forecast.



Map 5. One Period Harvest Opening Patch Size Distribution Forecast for 2019.



Map 6. One Period Harvest Opening Patch Size Distribution Forecast for 2029.



Map 7. One Period Harvest Opening Patch Size Distribution Forecast for 2059.

Rationale for variance:

The current status presented shows 20 years of blocks. The type-cutting strategy is a recent adoption so the past distribution is somewhat different than the future will be. In general, the block size distribution is of similar shape to the natural forest stand size distribution.

There will be periods when an individual company will not encounter complex shape stands. As well, harvest blocks amalgamate stands, so exact emulation of a natural distribution will not be possible.

The range of openings sizes created by harvesting may be restricted by cultural considerations (eg public opposition to large openings).

Indicator Monitoring Plans

The indicator will be compiled during the annual AVI depletions update and reported every 5th year in the annual indicator report.

4.5 Indicator 5: 2nd Growth Patch Size Distribution by Seral Stage at Future Points in Time

This indicator meets Alberta objective 1.1.1.2 a). This is one of the biodiversity objectives within the responsibilities of SRD.

What does this indicator mean?

ARE THE YOUNG PATCHES OF OPENINGS NATURAL & VARIABLE?

This indicator tracks the variability of sizes among 20 year accumulated second-growth forest stands regenerating from harvest blocks.

It is reported as a range of patch sizes.

This target displays that landscape young patch sizes are variable which, in turn, give some confidence that the future forest structure will be variable..

What is the Allowed Variance from the target?

None.

What Happens if Allowed Variance is Exceeded?

Address in the next DFMP in 2019.

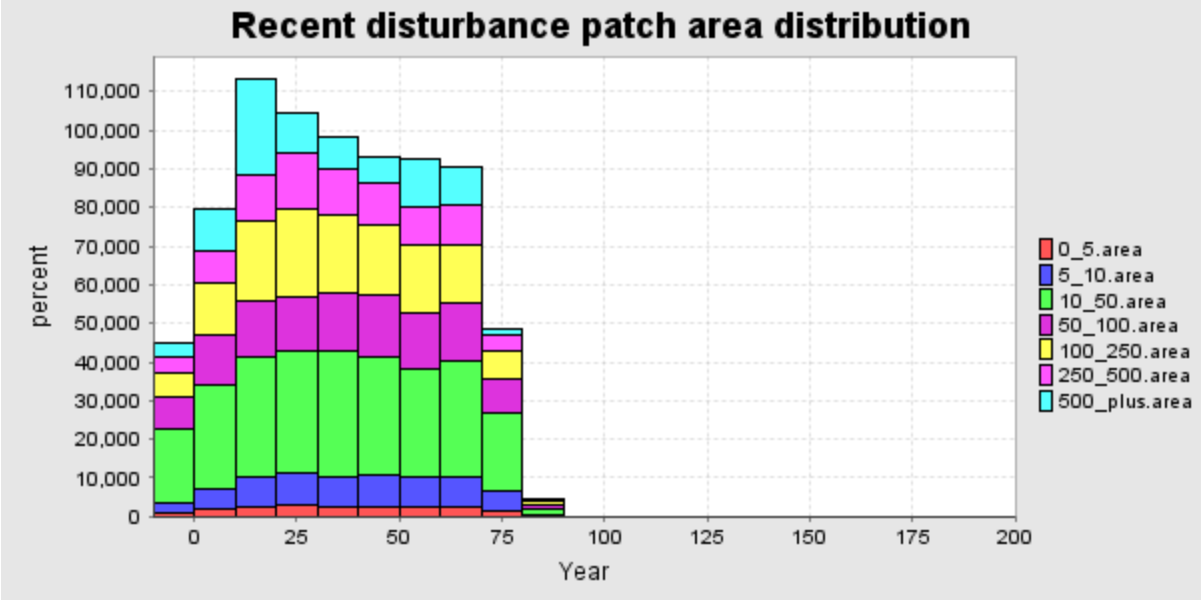
TARGET

The natural forest stand size distribution will be categorized into classes. The target is to maintain the range of variability forecast in the TSA.

Current Status and Forecasted Targets/Thresholds of Indicator

Forecast:

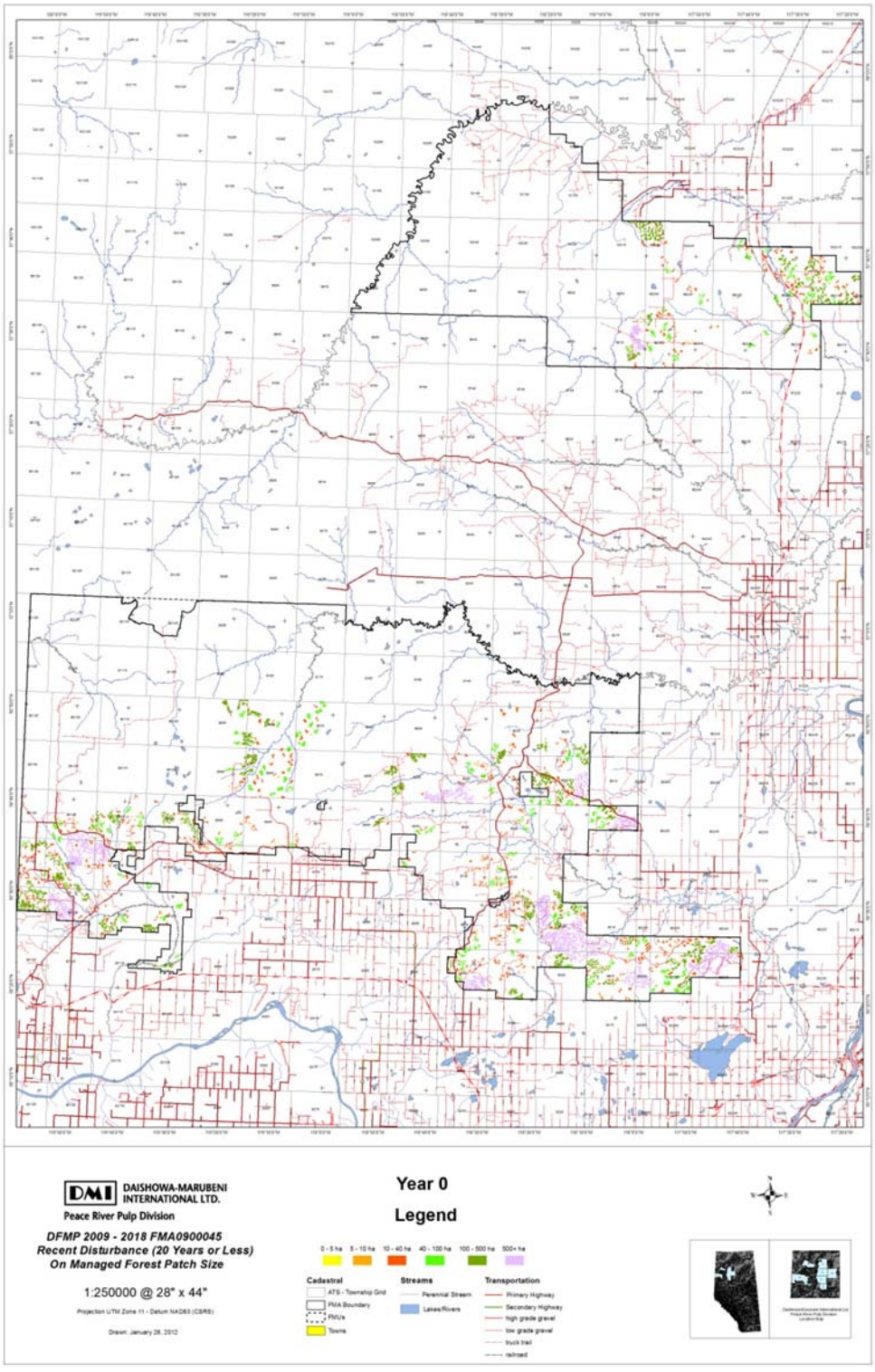
The 70 year SHS is used to predict the size distributions expected.



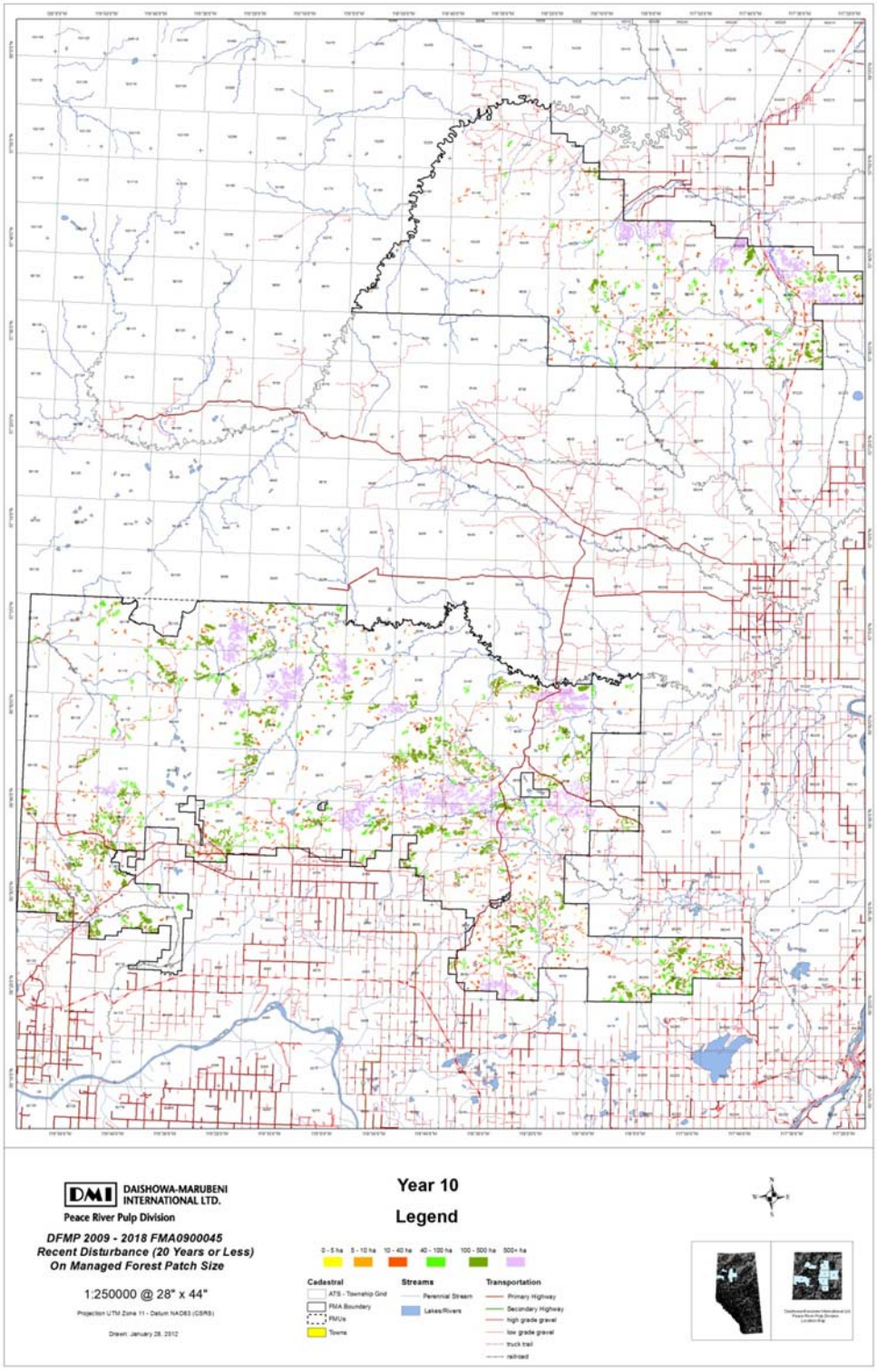
Recent disturbance is defined as the amount of contiguous area less than 20 years old.

Period	Year	patch.disturbance							Total
		0_5	5_10	10_50	50_100	100_250	250_500	500_plus	
		area	area	area	area	area	area	area	
0	0	1,138	2,371	19,414	7,901	6,213	4,221	3,758	45,016
1	10	1,963	5,279	26,748	12,866	13,780	8,252	10,430	79,318
2	20	2,534	7,783	30,963	14,687	20,261	12,040	24,890	113,158
3	30	3,000	8,497	31,471	14,056	22,709	14,271	10,606	104,611
4	40	2,604	7,557	32,455	15,237	20,382	11,790	8,145	98,170
5	50	2,456	8,120	30,726	15,922	18,328	10,750	6,953	93,254
6	60	2,643	7,731	27,728	14,401	17,534	10,090	12,312	92,437
7	70	2,705	7,590	30,193	14,734	15,272	10,018	9,855	90,366

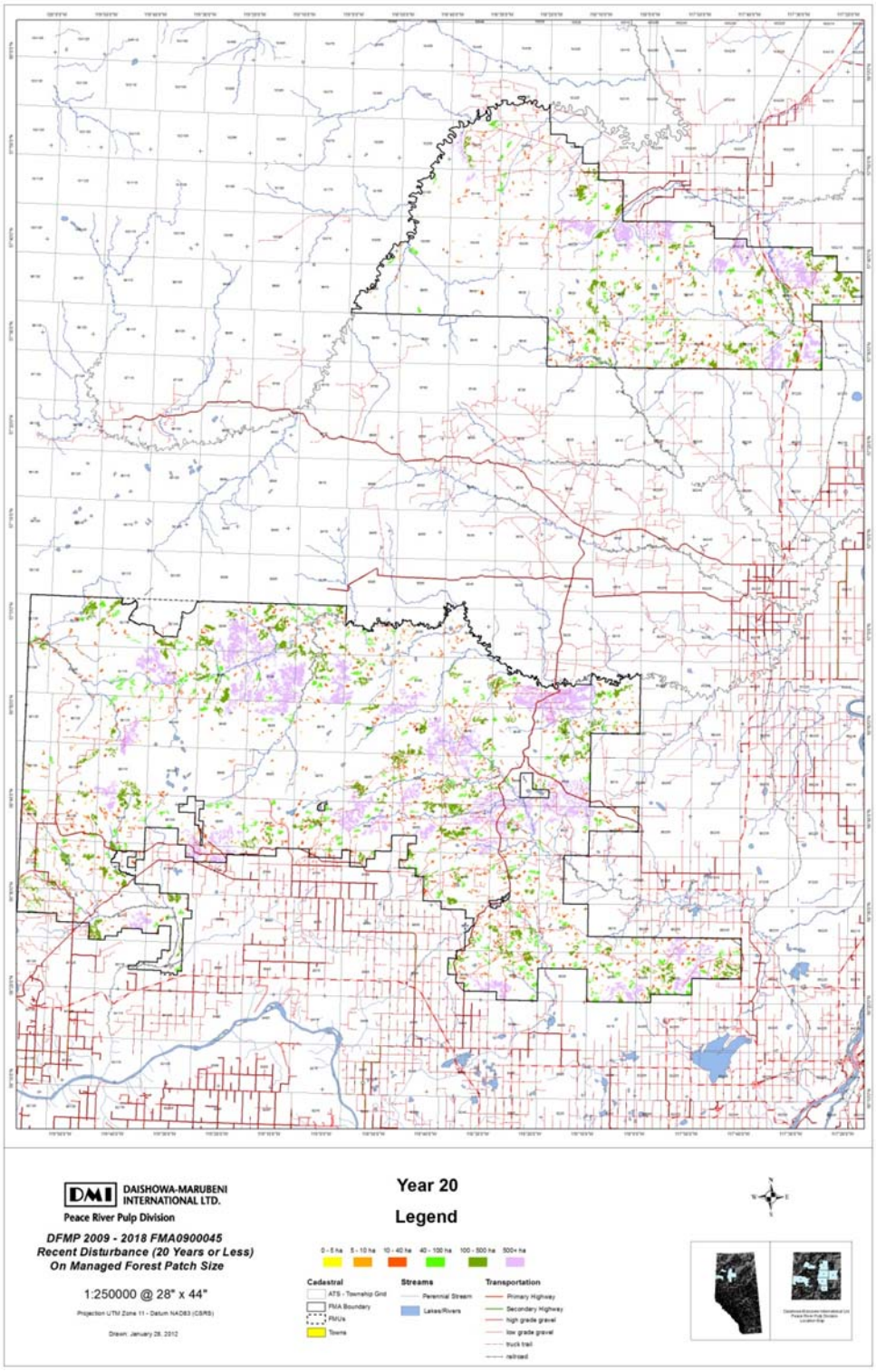
Figure 6. Forecast distribution of recent harvest patches. Harvest blocks less than 20 years old contribute to this metric. The first bar on the left of histogram is the start condition in 2009.



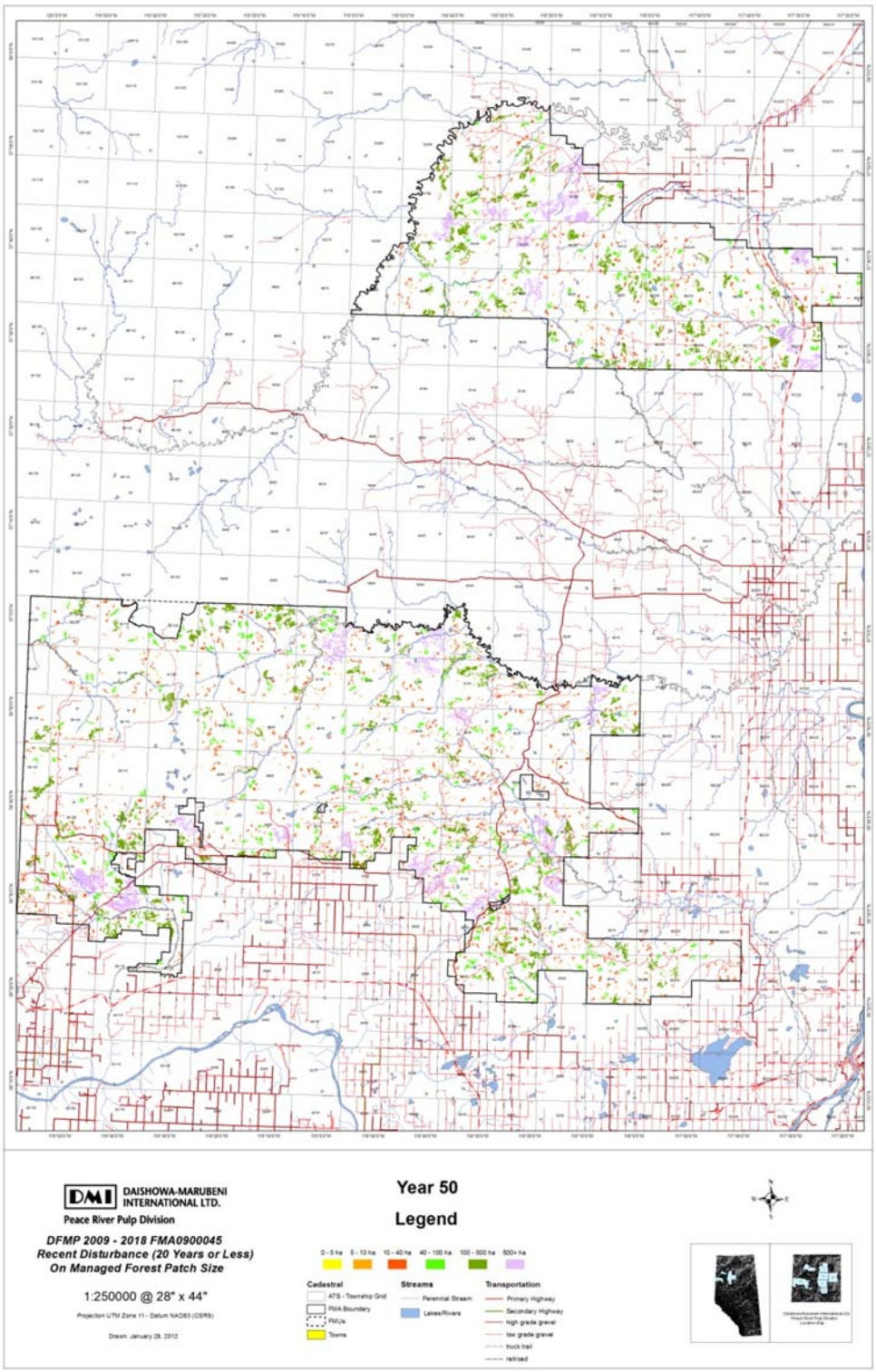
Map 8. Recent Disturbance Patch Condition for 2009. Patches are composed of contiguous net landbase harvested within the past 20 years.



Map 9. Recent Disturbance Patch Condition forecast for 2019. Patches are composed of contiguous net landbase harvested within the past 20 years.



Map 10. Recent Disturbance Patch Condition forecast for 2029. Patches are composed of contiguous net landbase harvested within the past 20 years.



Map 11. Recent Disturbance Patch Condition forecast for 2059. Patches are composed of contiguous net landbase harvested within the past 20 years.

4.6 Indicator 6: Interior Old Forest Core Area by CoverGroup at Future Points in Time.

This indicator meets Alberta objective 1.1.1.2 b). This indicator is one of the biodiversity indicators for which Alberta has responsibility to assess.

This indicator meets Alberta objective 1.1.1.2 b). This is one of the biodiversity objectives within the responsibilities of SRD. It is provided in this DFMP as a tracking indicator. The forest industry does not control all disturbance as therefore cannot control the performance of this indicator into the future. The forest industry, at best, can commit to follow the harvest sequence and track this indicator.

What does this indicator mean?

DOES THE FOREST CONTAIN OLD GROWTH COMPONENTS ARRANGED SO AS TO FUNCTION AS CORE AREAS?

Maintaining natural forest components in natural configurations may help conserve biodiversity that relies on old growth. This indicator addresses fragmentation in a socially sensitive forest type.

TARGET

Equal to or greater than 2009 baseline number

What Is the Allowed Variance From the Target?

Actual achieved levels cannot fall below 20% of forecast target. Target is achieved for at least 80% of planning period.

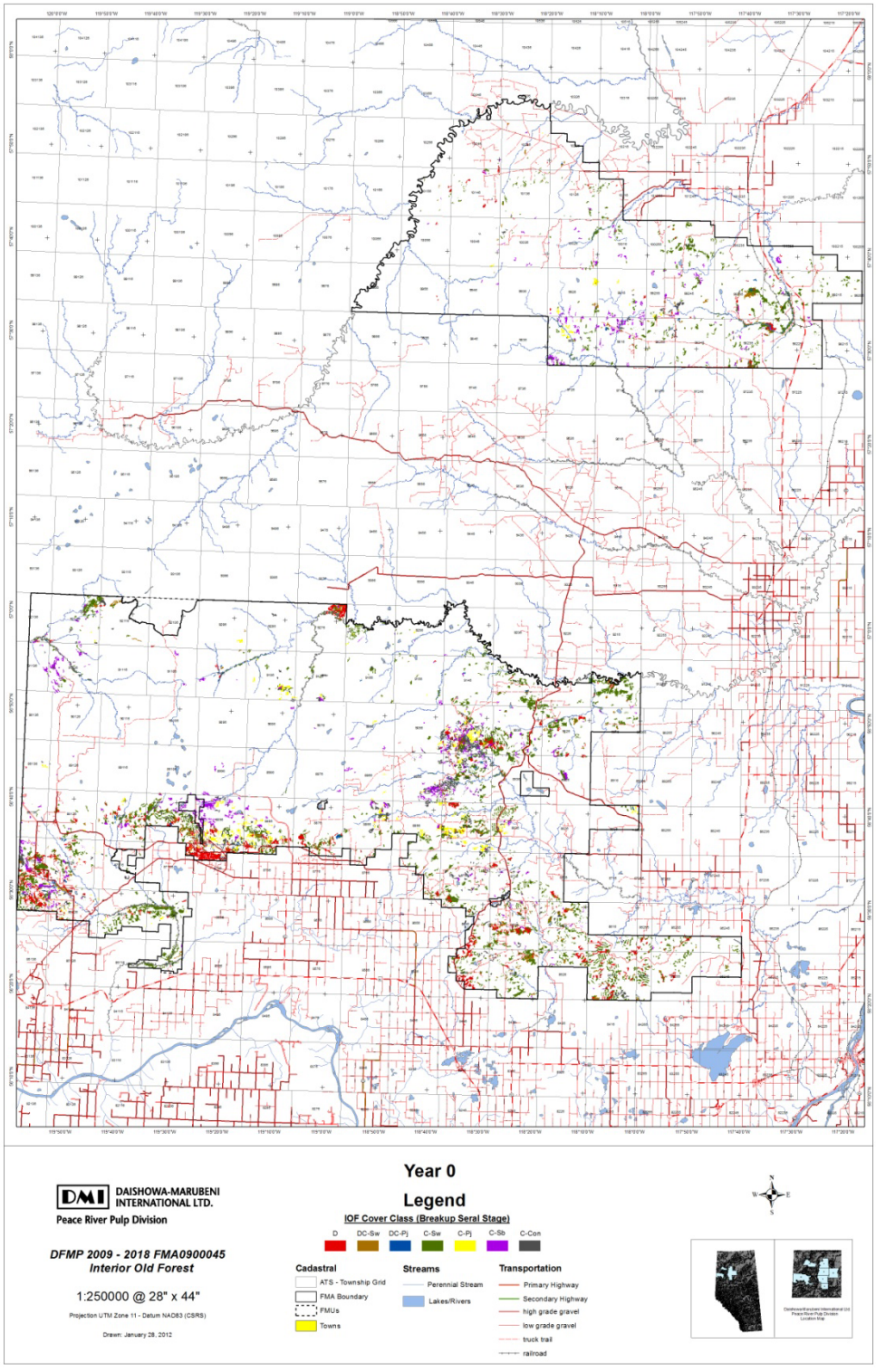
What Happens If Allowed Variance is exceeded?

Adjust in next DFMP.

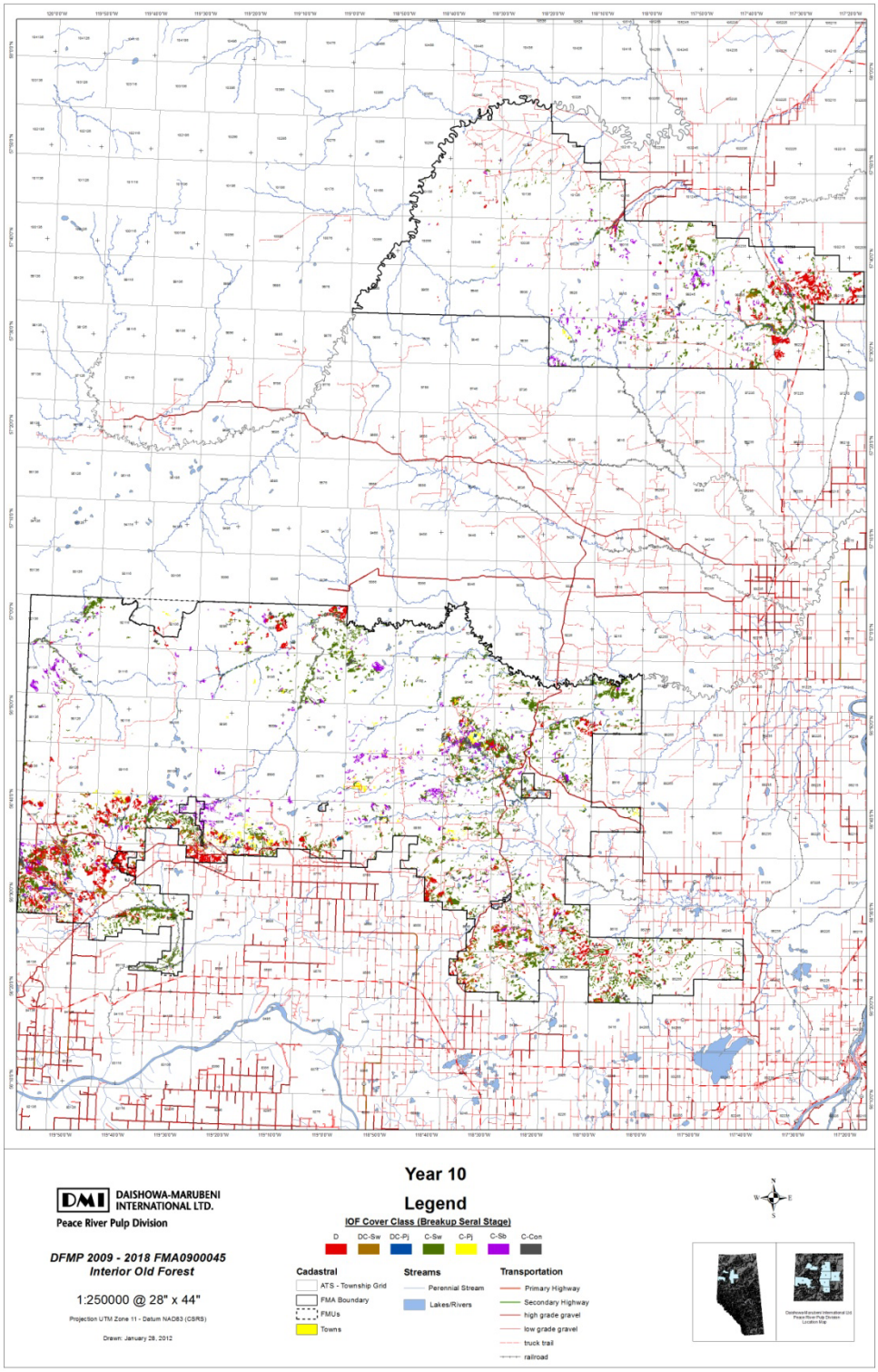
Current Status and Forecasted Targets/Thresholds of Indicator

Table 4. Interior old forest forecast for FMA 0900045.

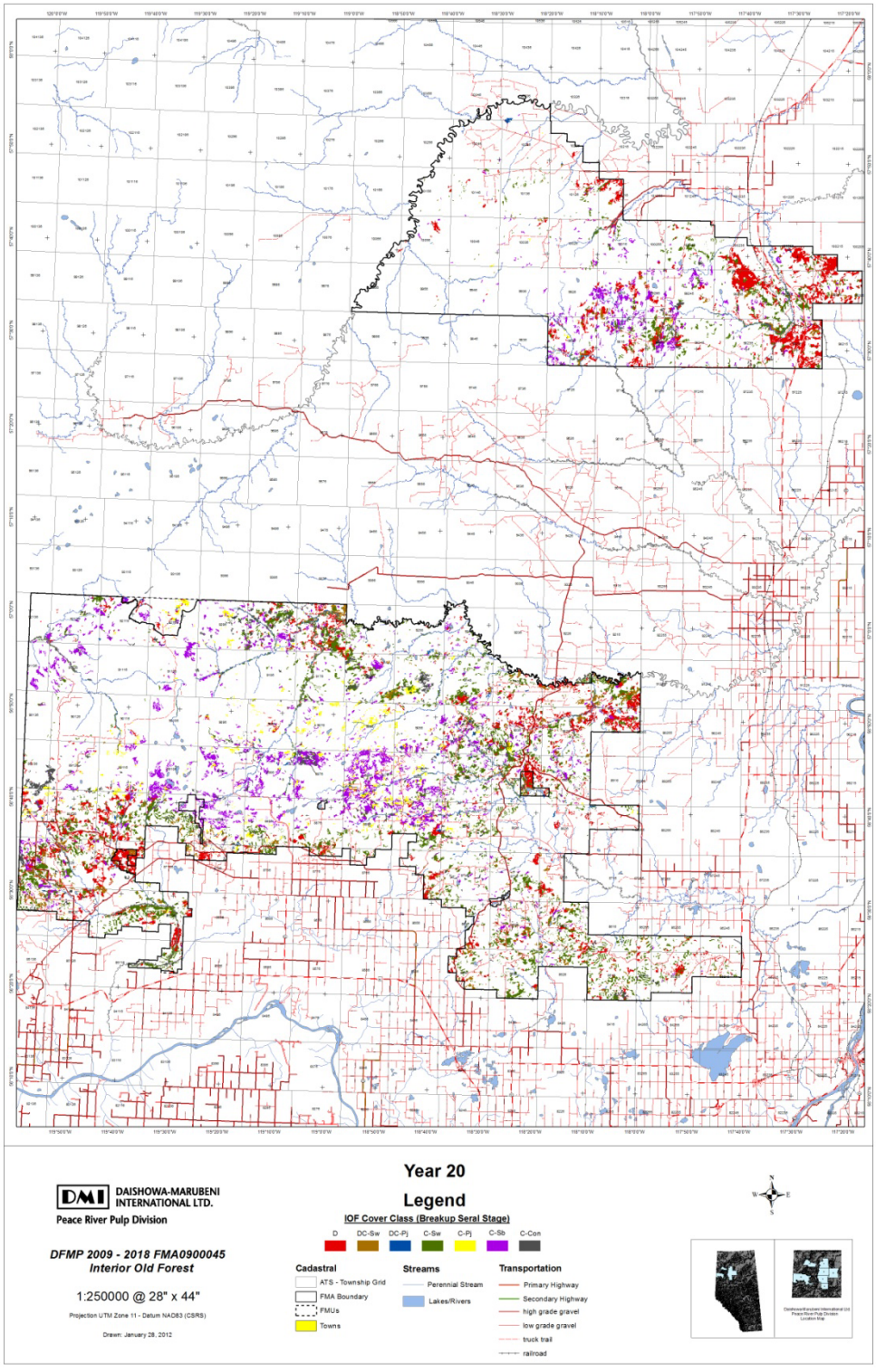
FMA0900045 Interior Old Forest Metrics				
		Year 0 Area Hectares	Year 10 Area Hectares	Year 50 Area Hectares
Cover Class	C_Con	2,391	1,703	5,000
	C_Pj	1,211	703	5,192
	C_Sb	2,397	3,536	44,011
	C_Sw	6,139	9,365	9,899
	D	2,356	6,472	11,114
	DC_Pj	130	258	710
	DC_Sw	1,037	1,847	3,977
SUM		15,661	23,884	79,903
Average Core Size		217 ha	257 ha	541 ha



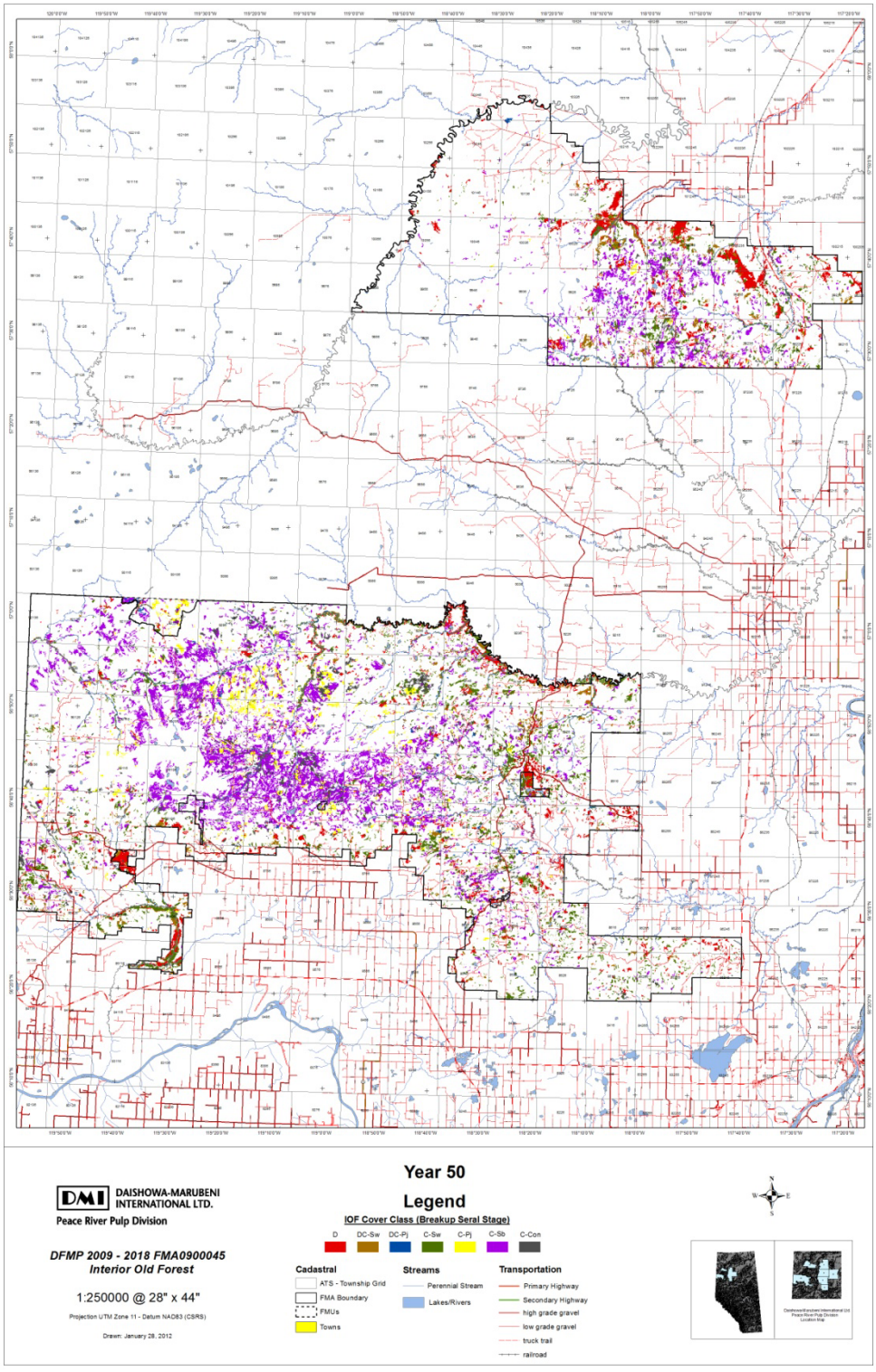
Map 12. Interior Old Forest Patches Forecast in 2009.



Map 13. Interior old forest patches forecast in 2018.



Map 14. Interior Old Forest patches forecast in 2028.



Map 15. Interior Old Forest Patches forecast in 2058.

Rationale for variance:

This is a baseline calculation. There is no variance at this time.

Indicator Analysis Information

Spatial Harvest Sequence is used. The sequence is passed through a series of spatial queries and filters within the Patchworks model. The model is used to grow the forest and forecast spatial conditions. A dissolved patch product is produced from which the summaries are produced.

Indicator Monitoring Plans

This indicator will be assessed every five years and reported on in the Stewardship Report.

4.7 Indicator 7: Annual achieved retention by company

This indicator meets Alberta objective 1.1.2.1.a)

What does this indicator mean?

WILL THE 2ND CROP OF TREES HAVE NATURAL STRUCTURE AT THE STAND LEVEL?

This indicator shows the area of cutovers that have trees purposely left standing over it. The retained trees in cutovers are meant to act the same as dead trees and live skips in natural fires.

The retention will make the next crop of trees function more like a natural fire origin stand.

Retention targets are set for the forest within the DFMP and then supported by block-level targets that are monitored annually to provide the feedback necessary to meet the forest level target. Quota holders within the areas have the option to follow DMI's retention policy or to develop and follow their own. The final selected route is detailed in the Operating Ground Rules Document.

TARGET:

Targets for retention are dependent upon the strategy adopted by the company operating on the FMA as shown in Table 5:

Table 5. Retention by company in FMA 0900045

Tenure	Policy	Target %	
		Merchantable	Other*
DMI	DMI	15	
Canfor	DMI	15	
Zavisha	Zavisha	1	
Tolko	Tolko	1	4

* Standing dead, broken or decaying trees, trees identified as having dens.

What Is the Allowed Variance From the Target?

Zero (0) on a 5 year window.

Retention policies in pine beetle blocks override these targets and variances. There are no variance limits on retention in pine salvage/sanitation operations.

What Happens If Allowed Variance is Exceeded?

If retention target is exceeded, the annual allowable cut is adjusted down to reflect.

If retention is underachieved, the next DFMP will be adjusted appropriately.

The retention prescriptions are adjusted annually to stay on target.

A long term trend of variance will result in changes at the next DFMP.

Current Status and Forecasted Targets/Thresholds of Indicator

Current Status:

Retention Performance for DMI, Canfor and Zavisha.

Operating Year	Company	Harvest Area (ha)	Large Patch		Small Patch		Total	
			Area (ha)	%	Area (ha)	%	Area (ha)	%
2009	DMI	409.0	47.4	11.6%	22.7	5.6%	70.1	17.1%
	CANFOR	0		0.0%		0.0%		0.0%
	Zavisha	0		0.0%		0.0%		0.0%
	Subtotal	***409.0***	***47.4***	11.6%	***22.7***	5.6%	***70.1***	17.1%
5-Year Total	DMI	***409.0***	***47.4***	11.6%	***22.7***	5.6%	***70.1***	17.1%
	CANFOR	***0.0***	***0.0***	0.0%	***0.0***	0.0%	***0.0***	0.0%
	Zavisha	***0.0***	***0.0***	0.0%	***0.0***	0.0%	***0.0***	0.0%
	Subtotal	***409.0***	***47.4***	11.6%	***22.7***	5.6%	***70.1***	17.1%

Note:

Retention for Tolko

Year	Harvest Area (ha)	Merchantable		Other*		Total	
		Area (ha)	%	Area (ha)	%	Area (ha)	%
2009	0	0	0	0	0	0	0
Total	***0***	***0***	***0***	***0***	***0***	***0***	***0***

**Residual material consisting of lesser vegetation, standing dead, broken or decaying trees, dens or nests, understory, unique flora and/or terrain features.*

Retention for Seehta, Boucher, Buchanon, and 113341

Year	Company	Harvest Area (ha)	<24 ha		24 - 100 ha		> 100 ha		Total	
			Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%
2009	Seehta	0	0	0	0	0	0	0	0	0
	Boucher	0	0	0	0	0	0	0	0	0
	Buchanon	0	0	0	0	0	0	0	0	0
	113341	0	0	0	0	0	0	0	0	0
	Subtotal	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Total	Seehta	0	0	0	0	0	0	0	0	0
	Boucher	0	0	0	0	0	0	0	0	0
	Buchanon	0	0	0	0	0	0	0	0	0
	113341	0	0	0	0	0	0	0	0	0
	Subtotal	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***

Rationale for variance:

DMI:
The variance shown is based on planned retention levels since the retention inventory for the 2009 operating season is not scheduled for completion until early 2011. If planned levels of variance are reflected in the actual retention numbers, consideration will be given to lower levels of large patches and increase levels of single stem retention where site conditions and block configuration warrant it.

Analysis Comments / Discussion

Since the completion of aerial photography of harvest areas occurs during the the year following harvest, the complete statistics were not available to report on at the time of this report. A detailed retention report is scheduled for completion in 2012.

Indicator Monitoring Plans

The indicator will be compiled during the annual AVI depletions update and reported every 5th year in the Stewardship Report. Conifer operators will provide reports to DMI.

4.8 Indicator 8: Quota Holder Conifer Landbase Achieved DWD Amount by Company

This indicator meets Alberta objective 1.1.2.1 b)

What does this indicator mean?

IS A NATURAL LEVEL OF DEADWOOD LEFT IN CUTBLOCKS ?

This indicator shows the amount of downed woody debris left in cutblocks.

This indicator is applicable to those companies not following the large level retention strategy adopted by DMI (large amounts of retention ensure a continued supply of dead wood into the future)

Dead woody debris (both standing and laying on the forest floor) are stand level structure components of a natural forest. The dead wood structure aids in soil productivity, wildlife habitat, tree species succession, and many other ecological functions. Harvested forests that eliminate downed woody debris, suffer the loss of some ecological components.

ASRD requires companies to maintain some unspecified proportion of cutblocks to have DWD amounts equivalent to pre-harvest conditions. This indicator demonstrates the level of compliance with that ASRD directive.

TARGET

To be determined (Tolko, Zavisha strategies to meet ASRD requirements) in Ground Rule negotiation process

What is the Allowed Variance From the Target?

To be determined (Tolko, Zavisha).

What happens if Allowed Variance is Exceeded?

Root cause is examined and an action plan is developed to correct performance. Adjust planning and operational strategies in subsequent year.

Current Status of Indicator

Company	Pre-Harvest Benchmark	Post-Harvest Target	Post-Harvest Result (Sample Year -)	Variance
Tolko				
Zavisha				

Rationale for variance:

Has not been measured yet.

Indicator Monitoring Plans

Quota Holders will define their process and reporting structure within the Ground Rule negotiation. The levels will be annually supplied to DMI for inclusion in the indicator report. Results will be summarized in the 5 year Stewardship Report.

4.9 Indicator 9: Presence of Caribou & Grizzly species

This indicator meets Alberta objective 1.2.1.1.

What does this indicator mean?

ARE AT-RISK SPECIES REMAINING PRESENT IN LOCAL FORESTS?

This indicator shows whether identified at-risk species continue to live on the DFA.

The baseline is confirmed presence of the species within the region at the start-point of company activity. This indicator relies on external sources and merely tracks species presence at 10-year periods relative to that start-point.

Forest management is only one part of a complex set of factors influencing wildlife. This indicator is a tracking of at-risk species given the cumulative effects of many factors.

The intent in tracking “species presence” is not to provide a performance indicator on forest management nor does it describe population levels, species abundance, population viability or species fitness.

The DFMP tracks this to provide one input into a collaborative management / recovery team plan at the provincial level.

TARGET:

Greater than 0

What is the Allowed Variance From the Target?

Target must be achieved or exceeded at the end of 10-year FMP term, unless government policy and species recovery objectives change.

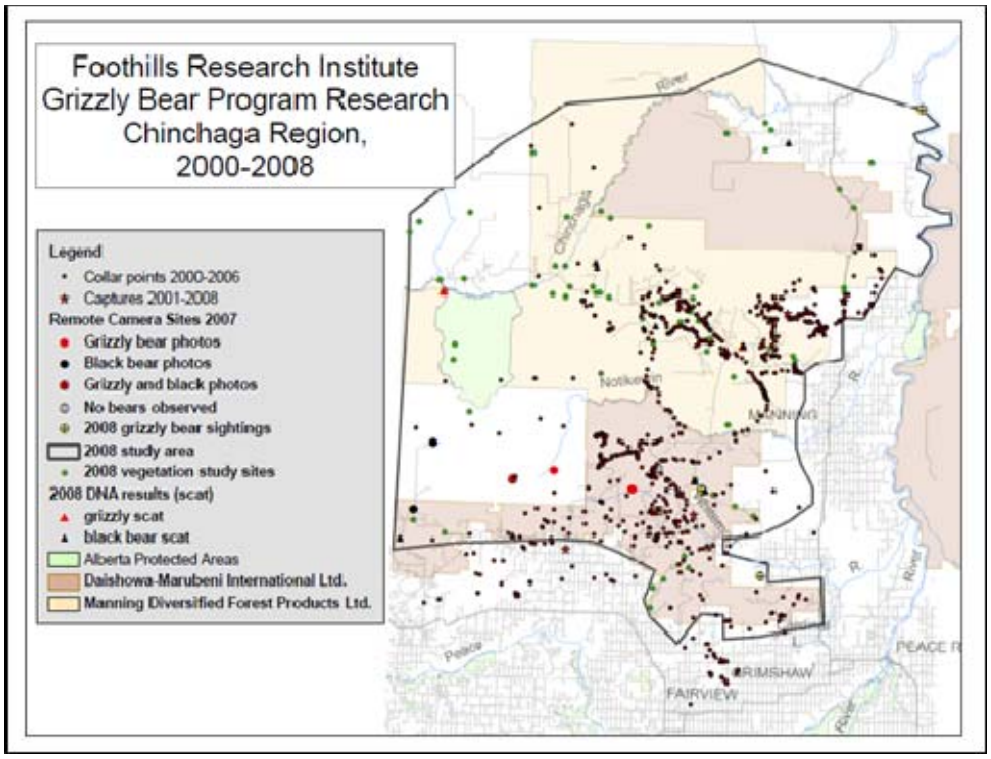
What happens if Allowed Variance is Exceeded?

Advance detection of impending non-desirable outcome: If combined government/industry data-sources begin to suggest impending species loss prior to 10th-year assessment, engage dialogue and participation in government local action-planning for at-risk species.
Root cause is examined considering cumulative landscape factors and a revised action plan is developed to merge forest sector practices with current government species recovery strategies.

Adjust strategies in subsequent FMP (or earlier as directed by government recovery strategies).

Current Status of Indicator

Species	Current Local Status (presence/absence)	Confirmation Type	Observation Source
Woodland Caribou	Species still present	Sightings 2008 (Twin Lakes)	DMI staff
		Sighting data to-2009 (All 4 herds)	DMI staff
			ASRD (Alberta Caribou Committee –Data)
Grizzly Bear	Species still present	Track observations (P13) - 2009	DMI + EMEND staff
		Sightings -2009 (P16, P10)	DMI ops-contractor staff
		Sightings -2010 (P13)	DMI consultant, ASRD staff
		Collaring + observation data -2009-2010	ASRD staff (FWMIS)
		Collaring data -2006-2008	Foothills Research Institute



Map 16. Grizzly bear locations 200-2008.

Rationale for variance:

No variance at this time.

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Build internal system	Require business rule for reporting and internal system for recording/outputting at-risk species sightings (company, contractors, consultants staff)	DMI (shared reporting assistance of sawmills)	One time (2010)
Acquire data	Gather external & internal data	DMI	Annual capture + archive
Analysis	Inquire about any years when 0-data exists. (causal evaluation) Compile records	DMI	Annual 10-year (next 2019)
Report	Indicator performance management report Management strategy re-alignment with recovery strategy as needed	DMI	10-year

4.10 Indicator 10: Recovery team population estimates for Grizzly and Caribou

This indicator meets Alberta Objective 1.2.1.1.

What does this indicator mean?

WILL LOCAL POPULATIONS OF AT-RISK SPECIES DECLINE OVER TIME?

This indicator shows whether identified at-risk species populations are maintained on the DFA.

The baseline is confirmed presence of the species within the region at the start-point of company activity. This indicator relies on external sources and merely tracks species presence at 10-year periods relative to that start-point.

How does this indicator relate to the DFMP and to SFM?

Establishing population targets for caribou and grizzly are a responsibility of government, as are any goals for self-sustaining populations normally set-out in the Recovery Plans. Monitoring for their populations and determination of species fitness trends for each, are within the mandate of the Province, along with coordination of species recovery efforts across all government and industry sectors. Effectiveness of forest management strategies within a collective recovery effort is widely debated and undetermined. The intent in tracking "populations" is not to provide a performance indicator on forest management, nor does it infer population viability or species fitness. Such a measure is arguably meaningless for forest management because of the cumulative influence of collective landscape human activity on the FMA, natural agents influencing forest habitat state on the FMA, and other limiting factors not within the exclusive realm of forest industry control (i.e. mortality sources). Population fluctuations are also a normal occurrence within the Natural Range of Variability ("NRV") and population data reliability is affected by monitoring capacity and sampling logistics of the agencies that monitor at-risk species.

TARGET:

Greater than 2009 level (09 population baseline estimate –federal, provincial sources)

What is the Allowed Variance From the Target?

Target must be achieved or exceeded at the end of 10-year FMP term, unless 2009 baseline numbers are announced to be in error, or government policy and species recovery objectives change.

What happens if Allowed Variance is Exceeded?

Advance detection of impending non-desirable outcome: If combined government / industry data-sources begin to suggest notable species population declines prior to 10th-year assessment, engage dialogue and participation in government local action-planning for at-risk species.

Root cause is examined considering cumulative landscape factors and a revised action plan is developed to merge forest sector practices with current government species recovery strategies.

Adjust strategies in subsequent DFMP (or earlier as directed by government recovery strategies).

Current Status of Indicator

Species	Pre-2001 Calculated Animals or Observations	Pre-2007 Calculated Animals or Observations	2007-08 Calculated Animals or Observations	2009-10 Calculated Animals or Observations
Woodland Caribou *				
Chinchaga	52?	31 to 156	28 to 177	250-300
Hotchkiss	N/A	to 58	N/A	
Red Earth	76?	29 to 128	29 to 110	250-350
Deadwood/Dixonville	3?	to 70	<10	40
Grizzly Bear (BMA 1+2A)**	141 (134+7)	N/A	40 (Speculative)	71 (Speculative)

* -2009-10 Alberta caribou data was taken from; Environment Canada. 2008. "Scientific Review for the Identification of Critical Habitat for Woodland Caribou, Boreal Population in Canada"

-Alberta herds are widely variable in dataset robustness, but subject to annual monitoring

-Chinchaga herd population was grouped recently with Hotchkiss herd in national report

** -2009-10 Grizzly data has been derived from 2010 Alberta species status report

Rationale for variance:

N/A (this is a baseline report, but also reflects changing techniques and methodology for population assessment over time)
techniques.

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Verify	Check current government species-recovery objectives (pop goals, changes)	DMI	Annual
Acquire data	Gather external data on population estimates.	DMI	Annual capture + archive
Analysis	Compare annual population estimates & inquire if changes. Compile records.	DMI	Annual 10-year (next 2019)
Report	Indicator performance management report Management strategy re-alignment with recovery strategy as needed	DMI	10-year

4.11 Indicator 11: % of Government identified Swan nesting lakes meeting required harvest rules

This indicator meets Alberta objective 1.2.1.1 and objective 1.1.2.2

What does this indicator mean?

ARE TRUMPETER SWANS PROTECTED DURING OPERATIONS?

This indicator shows that companies take special precautions when operating near identified swan nesting locations.

Trumpeter Swans are identified as a local at-risk species. Consequently, special measures are taken to protect them.

TARGET

100% Compliance

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is exceeded?

Regulatory Action
DMI Incident Tracking Triggered

Current Status and Forecasted Targets/Thresholds of Indicator

Percent of cut blocks meeting harvest rules adjacent to government identified Trumpeter Swan nesting Lakes.					
Tenure Holder	# Blocks Within 1 km Radius	Current Status (%)	Forecasted Target (%)	Variance (%)	Achieve Target by

DMI	0	100%	100 %	0	Immediately
CANFOR	0	100%	100 %	0	Immediately
Tolko			100 %	0	Immediately
Seehta Forest Products			100 %	0	Immediately
Zavisha Sawmill			100 %	0	Immediately
Boucher Bros. Sawmill			100 %	0	Immediately
Buchanan			100 %	0	Immediately
1113341 Alberta Ltd.			100 %	0	Immediately

*Current status based on operational data (if available).

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Compliance Audit	Document findings and report accordingly.	DMI/CANFOR	Annually starting in 2011.
Statement of enforcement action	Provide statement that no actions were levied. Scan government web site	Tolko, Zavisha	Annually starting in 2011

4.12 Indicator 12: Area of identified HCVF features by type

This indicator meets Alberta objective 1.1.2.2 and objective 1.2.1.1 and objective 1.4.1.1.

What does this indicator mean?

ARE IDENTIFIED SPECIAL FEATURES PROTECTED ?

This is a collection of indicators that track the inventory levels of identified features/areas that require different decision making than regular forest harvest areas.

What is the Allowed Variance From the Target?

There is no allowed variance.

What happens if Allowed Variance is Exceeded?

DMI initiates an incident in its tracking system.

Root cause is examined and an action plan is developed to mitigate impacts and prevent re-occurrence.

TARGET

The inventory levels of identified HCVF features will be equal to or greater than the 2009 in each future year. (ie levels will remain the same or increase).

All operational planning will consult the HCVF layers to ensure compliance.

Current Status and Forecasted Targets/Thresholds of Indicator

A selection of HCVF features is listed in the table below, and shown on Fig. 1:

HCVF feature	Examples	Area: west (ha)	Area: east (ha)
Designated Parks & Protected Areas	Sulpher Lake	TBD in 2012	TBD in 2012
Embedded Special Places	Provincial Protective Notations	TBD in 2012	TBD in 2012
Special Management Restriction Zones	Caribou Range	TBD in 2012	TBD in 2012
Trumpeter Swan Nest Sites		TBD in 2012	TBD in 2012
Unique Biodiversity Point Features	Raptor nests, mineral licks	TBD in 2012	TBD in 2012
Unique Cultural/Historical/Stakeholder point Features	Trapper Cabins, Gravesites, etc	TBD in 2012	TBD in 2012
Research Sites	Sample Plots, Research Plots	TBD in 2012	TBD in 2012
Incised Valleys & Steep Slopes	Peace River Breaks voluntary exclusion	TBD in 2012	TBD in 2012

.

Rationale for variance:

New features are continually being discovered during planning and operations and these features will be added annually to the existing inventories.

Landbase withdrawal to other land use by procedures beyond control of the companies is the only source of acceptable variance.

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)

Build spatial archive system	HCVF categories, labels, storage, links to composite layers, data layers integrity control (DATS), business rules (future site inputs)	DMI	One Time (2011)
Build activity constraints guidelines	Complete draft document, staff training	DMI	One time (2011)
Acquire data	Up-dates (HCVF point features and polygons)	DMI	Annual
Analysis	Query area calculation per HCVF feature type	DMI	Annual
Report	Indicator performance management report	DMI	Annual

4.13 Indicator 13: Area of Continuous Reserve Network

This is a voluntary CSA indicator.

What does this indicator mean?

ARE HIGH SENSITIVITY FORESTS EXCLUDED FROM HARVESTING?

This indicator will track the area (hectares) of connected forest cover that is unharvested.

What is the Allowed Variance from the Target?

There is no allowed variance resulting from harvesting actions of the companies.

It is possible that landbase withdrawals beyond the control of the companies may reduce the area of CRN.

What happens if Allowed Variance is Exceeded?

DMI initiates an incident in its tracking system.

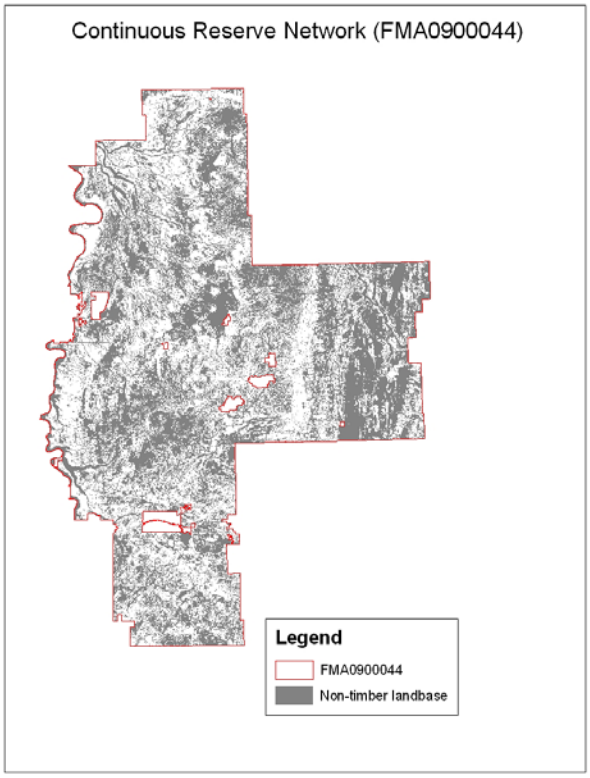
Root cause is examined and an action plan is developed to mitigate impacts and prevent re-occurrence. Depending on cause, it is possible that regulatory action may result.

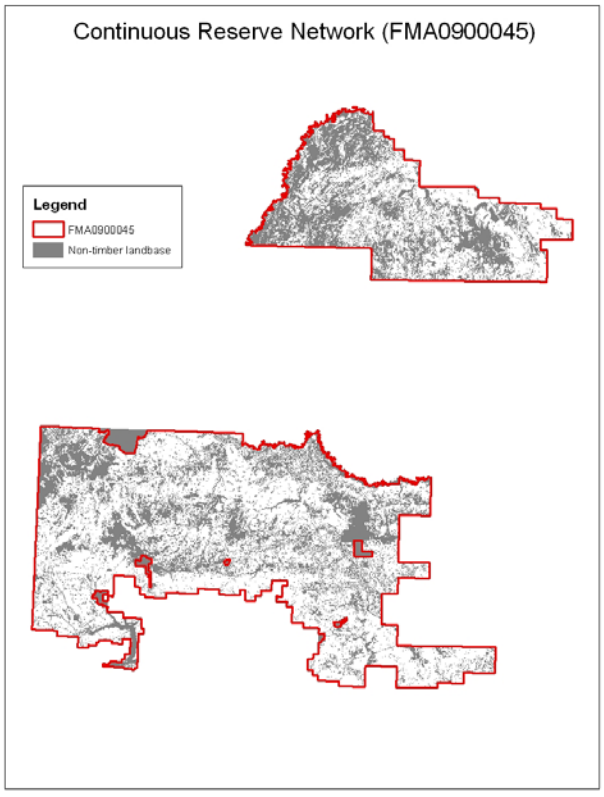
TARGET

The area of CRN in the future will be equal to or greater than 2009 levels.

Current Status and Forecasted Targets/Thresholds of Indicator

CRN feature	Area: west (ha)	Area: east (ha)
FMA Landbase excluded from timber-supply	350,208	831,310





Rationale for variance:

This is a baseline establishment and not an update – therefore there is no

variance at this time.

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Build spatial archive system	Define HCVF categories that contribute to CRN, labels, storage, links to composite layers, data layers integrity control (DATS), business rules (future site inputs)	DMI	One time (2010)
Acquire data	Up-dates (check for new CRN polygons)	DMI	Annual
Analysis	Query area calculation per FMA	DMI	Annual
Report	Indicator performance management report	DMI	Annual

Output for indicator reporting

This indicator will be reported in tabular format with a map in the 5 year Stewardship report.

4.14 Indicator 14: Area of government created protected areas

This Indicator meets the requirements of Alberta objective 1.1.2.2.

What does this indicator mean?

ARE THERE UNHARVESTED PROTECTED AREAS WITHIN THE FOREST?

This indicator will track the area (hectares) of Protected Areas within each FMA relative to the 2009 start-point as evidence of the forest management effort to continually respect and ensure their conservation.

What is the Allowed Variance from the Target>?

There is no allowed variance due to forest company action.

New Parks and protected areas may be designated by government, but existing ones are not expected to be removed.

What Happens if Allowed Variance is Exceeded?

If government action removed or added park area, then subsequent DFMP calculations would be adjusted appropriately.

If company actions imposed on Parks, regulatory action would ensue.

TARGET

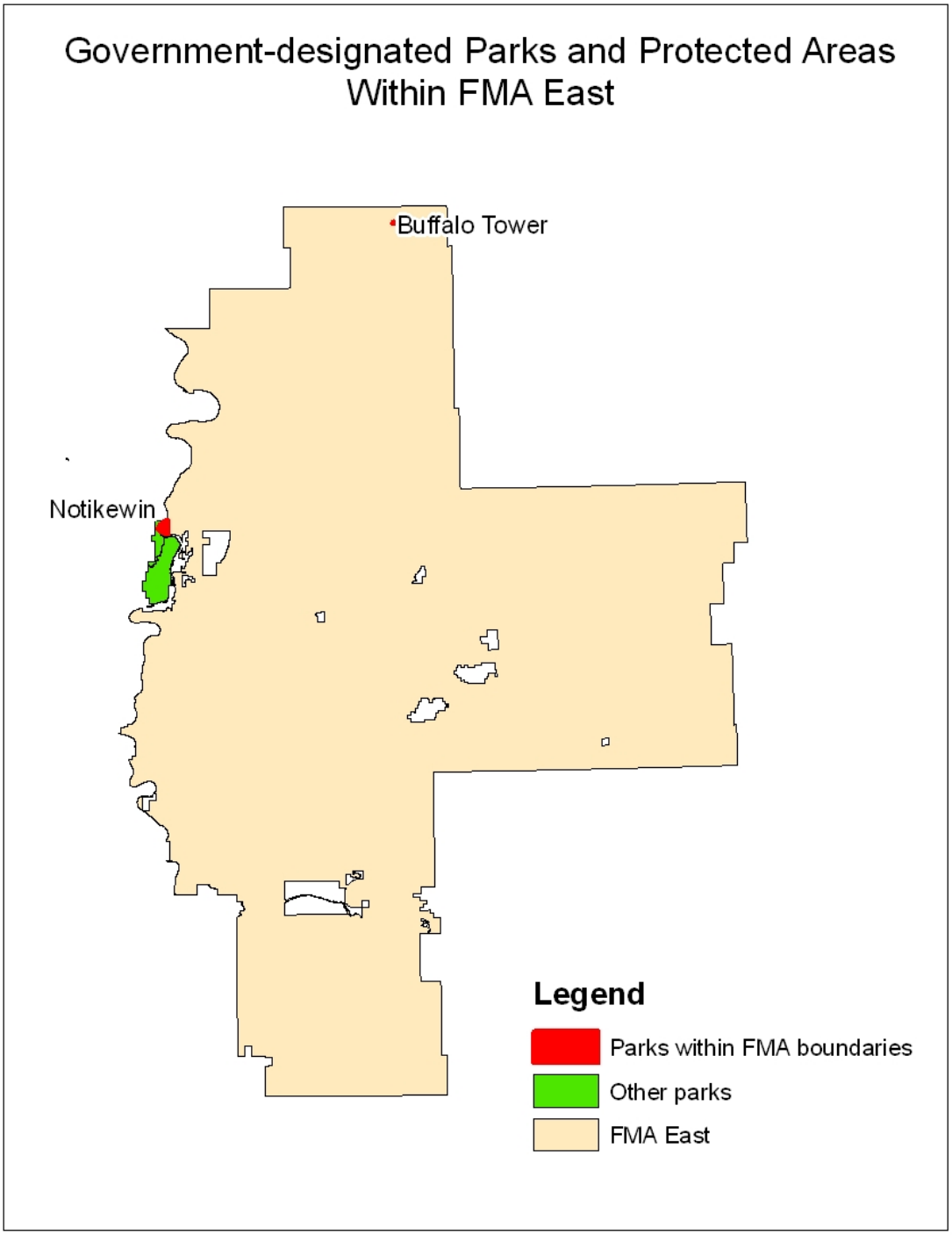
The area of protected areas within the DFA will be equal to or greater than 2009 levels far into the future.

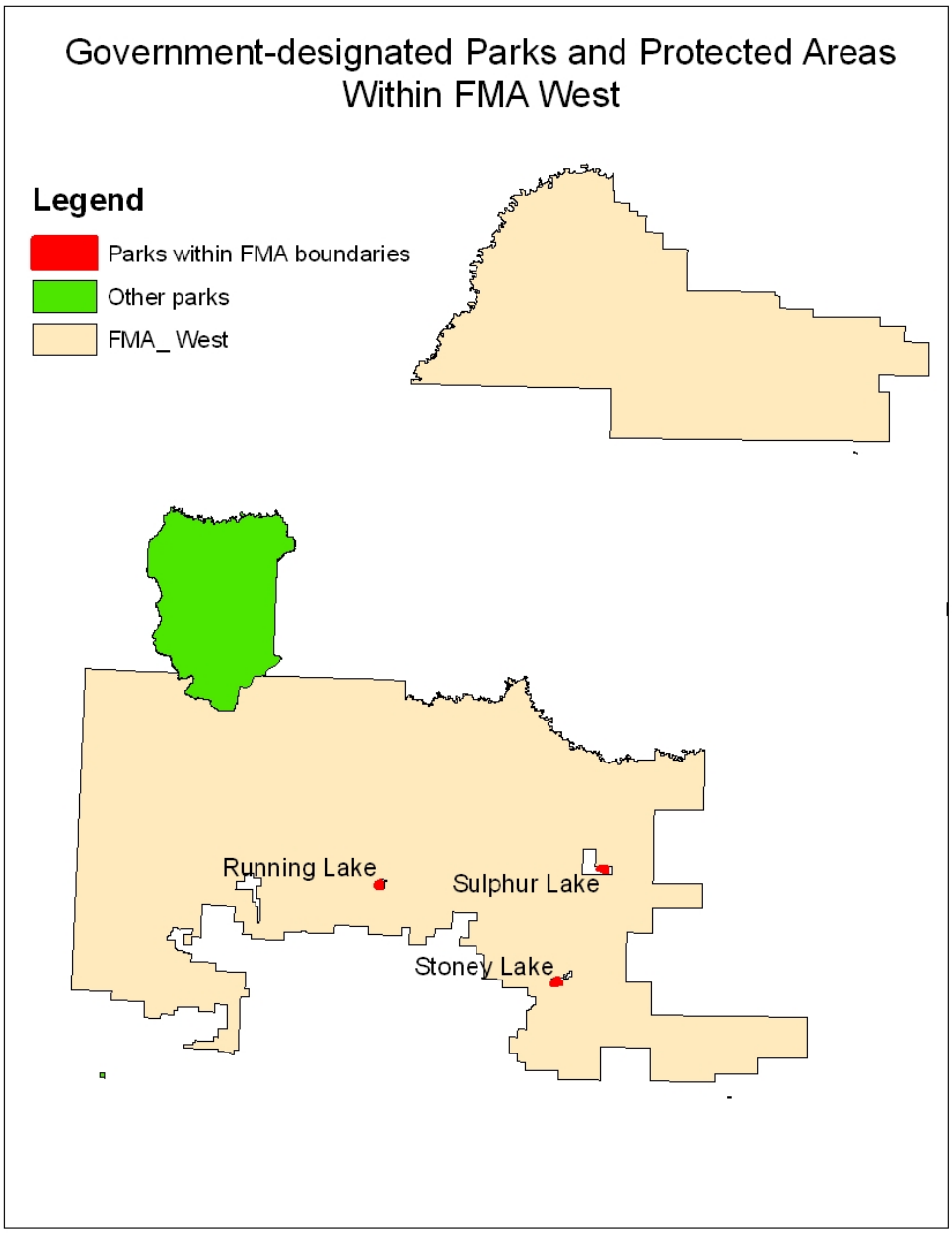
Current Status and Forecasted Targets/Thresholds of Indicator

Government Protected Areas and Parks within the DFA

	Current Status (2009) (ha)
FMA0900045	7158

FMA0900044 622





Rationale for variance:

There is no variance at this time.

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Acquire data	Up-dates (check for new Protected Area polygons)	DMI	Annual
Analysis	Query HCVF Parks area calculation per FMA	DMI	Annual
Report	Indicator performance management report	DMI	Annual

4.15 Indicator 15: Habitat Suitability Indices for selected species at future points in time.

This is a voluntary CSA indicator.

This is a new CSA core indicator that will be implemented by 2012.

The Province holds responsibility to perform habitat assessments on the DFMP model outputs but DMI is investigating a collaborative role in building capacity during 2012.

What does this indicator mean?

ARE SELECTED WILDLIFE HABITATS MAINTAINED ON THE DFA?

TARGET

To be determined in 2012.

What Is the Allowed Variance From the Target?

To be determined in 2012.

What Happens If Allowed Variance is exceeded?

To be determined in 2012.

Current Status and Forecasted Targets/Thresholds of Indicator

Incomplete.

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Develop HSI modeling capacity	Work with ASRD Hire contractor	DMI	2012
Implement HSI analysis on 2009 DFMP		DMI	2013

4.16 Indicator 16: Annual percentage of native species regeneration by company

This indicator is a voluntary CSA indicator.

What does this indicator mean?

WILL THE FUTURE FOREST BE MADE UP OF NATURAL SPECIES?

This indicator will report the percent of native tree species planted by company annually.

TARGET

The target is to plant 100% native tree species in reforestation activities.

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is exceeded?

DMI Incident tracking triggered
Regulatory Action
Adjustments in next DFMP

Current Status and Forecasted Targets/Thresholds of Indicator

Tenure Holder	Current Status (%)	Forecasted Target (%)	Variance (%)
DMI	100%	100 %	0
CANFOR	100%	100 %	0
Tolko		100 %	0

Tenure Holder	Current Status (%)	Forecasted Target (%)	Variance (%)
Seehta Forest Products		100 %	0
Zavisha Sawmill		100 %	0
Boucher Bros. Sawmill		100 %	0
Buchanan		100 %	0
1113341 Alberta Ltd.		100 %	0

*Current status based on operational data (if available).

Quota Holders can provide the data for this Report, or authorize DMI to extract the data from ARIS

Rationale for Variance:

There is no variance reported.

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Perform required planting activities	Develop planting plan, supervise contracts, submit data to ARIS	Reforestation Forester	Annually, data

4.17 Indicator 17: Area of in-situ reserves by seed zone by tree species

This indicator was originally included to satisfy the requirements of ASRD during detailed forest management planning. It has since been determined that none of the companies operating on the DFA perform artificial regeneration of the form that would require reserves to preserve natural genetics – the existing practices do not jeopardize gene conservation. Consequently, this VOIT is no longer required and will not be implemented.

The companies commit to respond appropriately if conditions change or if Alberta changes the rules surrounding this item. The companies will work with Alberta to meet Alberta's needs.

4.18 Indicator 18: Number of penalties and/or audit findings concerning failure to follow provincial tree improvement standards by company.

This indicator meets Alberta objective 1.3.1.2.

What does this indicator mean?

DOES REFORESTATION COMPLY WITH GENETIC REGULATIONS?

This indicator will annually track the number of penalties or independent-audit findings of failures per company to follow government regulatory standards concerning natural tree species genetic diversity and reforestation programs using plantation or nursery grown trees within the FMA.

TARGET

Zero (0)

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is exceeded?

DMI incident tracking triggered
Regulatory Action

Current Status and Forecasted Targets/Thresholds of Indicator

To date there have been no penalties or audit findings related to the failure to follow provincial tree improvement standards.

Licensee or Quota-holder	# of Penalties

Alberta Plywood	0
Boucher	0
Buchanan	0
Canfor	0
MDFP	0
Seehta	0
Tolko	0
Zavisha	0
DMI	0

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Acquire data	Independent internal audit (Record of auditor findings) Gather government records of compliance for DMI.	DMI, Canfor Tolko, Zavisha	Annual
Analysis	Summarize outcomes	DMI	Annual
Report	Indicator performance management report for management adjustment if necessary	DMI	Annual

4.19 Indicator 19: Annual percent of genetically modified (GMO) planted trees by company.

This indicator is a voluntary CSA indicator.

What does this indicator mean?

HOW MANY GENETICALLY MODIFIED TREES ARE PLANTED?

This indicator will track the proportion (%) of genetically modified trees planted on public forest land during annual reforestation programs using plantation or nursery grown trees.

The CSA framework for sustainable forest management prohibits the use of GMO planting stock. This indicator shows that the companies are not using GMO stock.

TARGET

Zero (0)

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is exceeded?

Regulatory Action
DFMP adjustment.

Current Status and Forecasted Targets/Thresholds of Indicator

Percent of genetically modified (GMO) planted trees by company				
Tenure Holder	**Current Status (%)**	**Forecasted Target (%)**	**Variance (%)**	**Achieve Target by**

DMI	0%	0 %	0	2011
CANFOR	0%	0%	0	
Tolko		0 %	0	
Seehta Forest Products		0 %	0	
Zavisha Sawmill		0 %	0	
Boucher Bros. Sawmill		0 %	0	
Buchanan		0 %	0	
1113341 Alberta Ltd.		0 %	0	

*Current status based on operational data (if available).

Rationale for variance:

There is no variance

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Compliance Audit	Document findings and report accordingly.	DMI	Annually starting in 2011.
Declaration	Declare that no GMO used	Quota Holders not using compliance audit	Annually starting in 2011

4.20 Indicator 20: Number of opportunities for adjacent stakeholders to voice input

This indicator meets Alberta Objective 1.4.1.1

What does this indicator mean?

DOES THE FMA HOLDER CONSULT ADJACENT STAKEHOLDERS?

Meaningful consultation is the foundation of CSA style management. This indicator demonstrates that DMI does provide opportunities for Consultation.

TARGET

Provide at least 4 meeting opportunities per year through the GDP process. Annually advertise for general consultation opportunity as part of the PAC process.

What Is the Allowed Variance From the Target?

0

What Happens If Allowed Variance is exceeded?

Review the need to change strategy

Current Status and Forecasted Targets/Thresholds of Indicator

DMI currently reports on consultation meeting opportunities in the GDP.

Rationale for variance:

There is no variance.

4.21 Indicator 21: Annual percent of sites identified as requiring protection that received appropriate protection by company.

This indicator meets Alberta objective 1.1.2.2.

What does this indicator mean?

WERE SITES PROTECTED AS REQUIRED?

Sites that are identified for reasons of special biological significance (e.g. bear dens, eagles nests) or that are identified by the government or first nations as protection areas (e.g. Parks) are protected from activities.

Target

100% of sites identified will be protected appropriately (DMI and Canfor to use compliance audit)

There will be 0 fines or infractions for quota holders not using the compliance audit.

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is Exceeded?

DMI Incident tracking triggered

Regulatory Action

Amend HCVF inventories

Current Status and Forecasted Targets/Thresholds of Indicator

Current Status:

To be implemented in 2012

Company	Sites Identified	Sites Appropriately Protected	% Compliance	# Fines/ Infractions
DMI				N/A
Canfor				N/A
Zavisha		N/A	N/A	
Boucher		N/A	N/A	
Seehta		N/A	N/A	
Buchanan		N/A	N/A	
1113341 Alberta Ltd.		N/A	N/A	

Rationale for variance:

Not implemented yet..

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions Required	Responsibility	Schedule (date/interval)
Maintain GIS unique sites layer.	Update from layout and operational finds.	Companies	Annual or as found
As-built database	Assess actions/buffers in accordance with unique site requirements.	Companies	Annual

Activity	Actions Required	Responsibility	Schedule (date/interval)
Declaration of no penalties	Report to DMI	Companies not performing compliance audits	Annual starting in 2012

4.22 Indicator 22: Percent of identified insect and disease areas scheduled for harvest.

This indicator meets Alberta objective 2.1.2.2.

What does this indicator mean?

DO WE HELP TO REDUCE THE IMPACTS OF INSECT AND DISEASE INFESTATIONS?

This performance indicator will track the annual proportion of identified insect or disease infestation areas that were scheduled for harvest as a requirement of government. It reveals the responsiveness of companies to contribute to government treatment strategies for forest infestations.

How does this indicator relate to the DFMP and to SFM?

The government is responsible to develop action strategies and coordinate treatments in response to high-risk insect or disease outbreaks (e.g. Mountain Pine Beetle –MPB). Infestations that can result in widespread death of forest and show an opportunity to spread to uninfected areas are considered high risk. These outbreaks hold negative consequences for forest ecosystem health as well as having large negative economic impacts.

Each outbreak will have different management strategies for control, sometimes including directed timber harvests that assist in controlling the spread to uninfected areas. When that occurs, forest harvest plans are modified to help in those control strategies. The Province will identify priority forest locations threatened by insects and disease. Companies will respond by scheduling harvests within them.

Target:

100% (as established by government regulation & direction)

What Is the Allowed Variance From the Target?

Infestations sometimes occur over large and sometimes remote areas of the landscape. Companies will assist where they can to harvest in areas to salvage and/or control the spread of infestations when it is economically and socially

feasible for them to do so.

Current Status and Forecasted Targets/Thresholds of Indicator

Current Status:

Percent of identified insect and disease areas scheduled for harvest.

Company	Infested Area (ha)			Target %	Variance %	Target Timing
	Identified	Harvested	%			
DMI	0	0	100	100	0	Annual
Canfor				100	-100	Annual
Zavisha				100	-100	Annual
Tolko				100	-100	Annual
Boucher Bros.				100	-100	Annual
Buchanon				100	-100	Annual
Seehta				100	-100	Annual
1113341 Alberta				100	-100	Annual
Total	0	0	100	100		

Rationale for variance:

Alberta has not mandated that companies harvest certain infested pine stands. The industry has been proactive in aligning their own planning to concentrate on pine content. This DFMP in VSA1 targets pine almost exclusively in the first 10 years.

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions Required	Responsibility	Schedule (date/interval)
Harvest Planning	-Review high priority areas identified by government and	Companies	Annual

	schedule harvests where feasible.		

4.23 Indicator 23: % of cutblocks achieving required reforestation standard by company

This indicator meets Alberta objective 2.1.1.1.

What does this indicator mean?

IS THE HARVESTED FOREST GROWING BACK?

This indicator will report on the percent of harvested blocks that have achieved the government requirements for acceptable reforestation as determined by the results of regeneration surveys.

TARGET

100% of harvest blocks will meet provincial reforestation standards.

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is exceeded?

Potential regulatory action
Retreatment of block
AAC penalty
Adjust future DFMP

Current Status and Forecasted Targets/Thresholds of Indicator

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Tenure Holder	Current Status (%)	Forecasted Target (%)	Variance (%)
DMI	99.7%	100 %	.3%

CANFOR		100 %	0
Tolko		100 %	0
Seehta Forest Products		100 %	0
Zavisha Sawmill		100 %	0
Boucher Bros. Sawmill		100 %	0
Buchanan		100 %	0
1113341 Alberta Ltd.		100 %	0

*Current status based on operational data (if available).

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DMI Annual Reforestation Report

Harvest Timber Year	Annual Harvest Area (ha)	Harvested Area Satisfactorily Stocked (%)	Accumulated Harvest Area (ha)	Accumulated Area Satisfactorily Stocked (%)	Survey Type
1991	2172	99.7%	2,172	99.7%	Performance Survey
1992	1080	97.8%	3,252	99.3%	Performance Survey
1993	749.6	100.0%	4,002	100.0%	Performance Survey
1994	2333	98.0%	6,335	99.4%	Performance Survey
1995	1694	100.0%	8,029	100.0%	Performance Survey
1996	1269	99.1%	9,298	99.9%	Establishment Survey
1997	3305	100.0%	12,603	100.0%	Establishment Survey
1998	3840	98.3%	16,443	99.7%	Establishment Survey
1999	2580	99.7%	19,023	100.0%	Establishment Survey
2000	2010	100.0%	21,033	100.0%	Establishment Survey
2001	1560	98.8%	22,593	99.9%	Establishment Survey
2002	3080	99.6%	25,673	100.0%	Establishment Survey
2003	3790	99.7%	29,463	100.0%	Establishment Survey
2004	2560	96.8%	32,023	99.7%	Establishment Survey
2005	1770	89.6%	33,793		89.6% of blocks surveyed*
2006	1360	61.5%	35,153		61.5% of blocks surveyed*
2007	2290	0.0%	37,443		0% of blocks surveyed
2008	1340	0.0%	38,783		0% of blocks surveyed
2009	1800	0.0%	40,583		0% of blocks surveyed

* all blocks surveyed to date from 2005 and 2006 Harvest Timber Year are satisfactorily restocked

Rationale for variance:

All companies will update reports in 2012 and report annually thereafter.

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Perform required regeneration surveys	Develop block list, supervise contracts, submit data to ARIS	Reforestation Forester	Annually; data submission by May 1 of the following year

4.24 Indicator 24: Opportunities for other industries to consult on footprint issues (ILM activity)

This indicator is a voluntary CSA indicator.

What does this indicator mean?

ARE COMPANIES WORKING TOGETHER TO MINIMIZE IMPACTS?

This indicator tracks the efforts of companies to work with other industries. The end goal is to minimize footprint on the landscape. This is an indirect measure of progress towards the goal of footprint management.

Cumulative impacts of multiple industries may have a negative impact on forest values. By demonstrating that forest managers are communicating with other industries, we show an attempt to manage footprint.

TARGET

The proposed target is to provide at least 4 opportunities per year for other companies to provide input into cumulative effects management.

What Is the Allowed Variance From the Target?

The number of opportunities may exceed 4 but not be less.

What Happens If Allowed Variance is Exceeded?

DMI management review

Adjust strategy.

Current Status and Forecasted Targets/Thresholds of Indicator

Current Status:

2010 to date: DMI has initiated 2 separate meetings with oil companies. GDP process invited input.

Rationale for variance:

This is a baseline establishment and not an update – therefore there is no variance at this time. DMI is on track to meet the target for 2010.

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

DMI will provide an annual summary in the indicator report.

4.25 Indicator 25: Annual forest landbase balance

This indicator meets Alberta objective 2.1.2.1. and element 4.2.

What does this indicator mean?

IS THE PRODUCTIVE FOREST LANDBASE GETTING SMALLER?

This indicator will annually track the net Landbase (hectares) available relative to a 2009 start-point land area, considering productive and nonproductive lands withdrawn and returned to the FMA.

Industrial and non-industrial activities impact a wide variety of benefits on the forest landscape. Management plans attempt to address the impact of the activities on the forest. Annual monitoring of losses can indicate when an adjustment to the plan is necessary. It also can reveal where opportunities for Integrated Land Management and reforestation of abandoned industrial sites exist. The loss of FMA land to industrial development results in long term loss of forest landbase both for wildlife habitat and new forests. Over time the effect of multiple years of development can create extensive changes to the forest landscape (cumulative net landbase loss).

TARGET

Annual net landbase loss equal to or less than 0.05% of 2009 level.

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is exceeded?

Next DFMP makes adjustments
If net loss is greater than 3%, Alberta provides compensation

Current Status and Forecasted Targets/Thresholds of Indicator

Table 6. Forest landbase balance 2010.

Calendar Year	Withdrawal			Return			Balance			% Change	Forecasted Target	Variance	Achieve Target by
	P	NP	Total	P	NP	Total	P	NP	Total				
2009	-330	-212	-542	11	110	121	-319	-102	-421	-0.016	<=0.05% (+/-)	0	
2010	-259	-126	-385	0	17	17	-259	-109	-368	-0.014	<=0.05% (+/-)	0	
Cumulative Total	-589	-338	-927	11	127	138	-578	-211	-789	-0.03	<=0.1% (+/-)	0	

*Current status based on operational data (if available). 2010 data current as of 02-Sep-2010.

Rationale for variance:

No variance reported – target is met.

4.26 Indicator 26: Annual Allowable Cut vs Annual Production by Company

This indicator meets Alberta objective 5.1.1.1.

What does this indicator mean?

DO WE OVER HARVEST THE FOREST?

This indicator will track the harvested timber volume per company each year relative to the sustainable annual allowable timber harvest level set by the government for the DFA.

The approved AAC is based on the landbase available for harvesting and the forest management strategies applied to that land. Harvesting within the levels determined from the timber supply analysis helps to ensure the ability of the forest to continue to provide all forest values in the future.

TARGET:

All harvesting will be at levels at or below the approved sustainable annual allowable cut. (by species and by company)

What Is the Allowed Variance From the Target?

The annual cut is reconciled every 5 years. The 5 year total may be up to 110% of the AAC provided the actual cut in the next 5 years is reduced to adjust. Thus the total actual cut over any 10 year period must be equal to or less than the combined 10 years' AAC.

It is allowed to have a harvest level in one year that exceeds the AAC as long as the 5 year total is within the 5 year AAC.

What Happens If Allowed Variance is Exceeded?

If the allowed variance is exceeded, additional explanations will be provided for justification.

Regulatory Action may occur

AAC may be reduced

Adjust at next DFMP

Current Status and Forecasted Targets/Thresholds of Indicator

Current Status:

FMA Production*

Deciduous Volume

Company	AAC	Annual Production 2009	
	(m3)	Vol	%AAC
DMI	962,446	325,777	34%
Total	***962,446***	***325,777***	***34%***

Coniferous Volume

Company	AAC	Annual Production 2009	
	(m3)	Vol	%AAC
DMI	117,026	103,293	88%
Canfor	226,886	189,434	83%
Zavisha	20,918	-	0%
Tolko	76,618	-	0%
Boucher Bros.	24,279	-	0%
Buchanon	79,351	-	0%
Seehta	135,423	-	0%
1113341 Alberta	13,600	-	0%
Total	***694,101***	***103,293***	***15%***

**Combined production of FMA0900044 and FMA0900045*

Rationale for variance:

There is no variance.

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions Required	Responsibility	Schedule (date/interval)
Report volumes to TPRS	Determine product by volume and report to the ASRD Timber Product Reporting System.	Destination company	Monthly, quarterly, annual Final reports due May 31 annually.

4.27 Indicator 27.

Number 27 is not used.

4.28 Indicator 28: Annual Percentage of harvest blocks without reportable rutting issues by company

This indicator meets Alberta objective 3.1.1.2.

What does this indicator mean?

DOES THE COMPANY PREVENT SOIL DAMAGE FROM LOGGING?

This performance indicator will track the proportion (%) of the total annual number of harvest blocks lacking rutting issues that are of a reportable gravity. It reveals the quality of company controls, staff training and operational monitoring to prevent serious incidents of soil damage (rutting).

TARGET

100% (as set by government regulation)

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is exceeded?

DMI Incident Tracking Triggered
Regulatory Actions may result
Site Remediation may be immediately required

Current Status and Forecasted Targets/Thresholds of Indicator

Annual Percentage of harvest blocks without reportable rutting issues by company				
Tenure Holder	**Current Status (%)**	**Forecasted Target (%)**	**Variance (%)**	**Achieve Target by**

DMI	100%	100 %	0	2011
CANFOR	100%	100 %	0	
Tolko		100 %	0	
Seehta Forest Products		100 %	0	
Zavisha Sawmill		100 %	0	
Boucher Bros. Sawmill		100 %	0	
Buchanan		100 %	0	
1113341 Alberta Ltd.		100 %	0	

*Current status based on operational data (if available).

Rationale for variance:

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Compliance Audit	Document findings and report accordingly.	DMI	Annually starting in 2012.
Declaration	Write declaration of no rutting and no penalties	Quota Holders not completing compliance audit	Annually starting in 2012.

4.29 Indicator 29: Annual percent of forest area disturbed by roads and landings by company.

This indicator meets Alberta objective 3.1.1.1.

What does this indicator mean?

DOES THE COMPANY MINIMIZE SOIL IMPACTS?

This indicator will track the proportion (%) of total annual harvest block area (hectares) that has mineral soil exposure occurring from construction of roads, landings and other clearings. It provides a measure of company planning and operational controls to minimize long-term impacts in forest recovery, vegetation growth-rates and soil productivity within cutblocks.

TARGET

Less than 5% (as set by government regulation)

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is exceeded?

Regulatory Action may occur
Adjustment of DFMP

Current Status and Forecasted Targets/Thresholds of Indicator

To be implemented in 2012

Annual percent of forest area disturbed by roads and landings by company				
Tenure Holder	**Current Status (%)**	**Forecasted Target (< 5%)**	**Variance (%)**	**Achieve Target by**

DMI		100 %	0	Immediately
CANFOR		100 %	0	
Tolko		100 %	0	
Seehta Forest Products		100 %	0	
Zavisha Sawmill		100 %	0	
Boucher Bros. Sawmill		100 %	0	
Buchanan		100 %	0	
1113341 Alberta Ltd.		100 %	0	

*Current status based on operational data (if available).

Rationale for variance:

Not implemented yet..

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
As-built Survey	Calculate disturbance from in-block road/landing construction.	Each Tenure Holder	Annual.
Compliance Audit	Document findings and report accordingly.	DMI/CANFOR	Annually starting in 2012.

4.30 Indicator 30: Annual number of significant surface erosion events related to silviculture, harvesting, and road activities by company

This indicator meets Alberta objective 3.1.1.2.

What does this indicator mean?

IS WATER QUALITY PROTECTED?
IS SOIL PRODUCTIVE CAPACITY PROTECTED?

This performance indicator will track the number of events per company of significant soil erosion within the FMA caused by any type of forest management operations. The indicator will demonstrate the quality of company practices, monitoring, responsiveness and erosion controls to prevent such serious incidents.

TARGET

Zero (0) - (set by government regulation)

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is exceeded?

DMI Incident Tracking Triggered
Immediate Site Remediation
Adjust Practices

Current Status and Forecasted Targets/Thresholds of Indicator

Annual number of significant surface erosion events related to silviculture, harvesting, and road activities by company				
Tenure Holder	**# of Major Erosion Events**	**Forecasted Target**	**Variance (%)**	**Achieve Target by**

Annual number of significant surface erosion events related to silviculture, harvesting, and road activities by company				
Tenure Holder	**# of Major Erosion Events**	**Forecasted Target**	**Variance (%)**	**Achieve Target by**
DMI	0	0	0	Immediately
CANFOR	0	0	0	Immediately
Tolko		0	0	
Seehta Forest Products		0	0	
Zavisha Sawmill		0	0	
Boucher Bros. Sawmill		0	0	
Buchanan		0	0	
1113341 Alberta Ltd.		0	0	

*Current status based on operational data (if available).

Rationale for variance:

There is no variance at this time

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Compliance Audit	Document findings and report accordingly.	DMI/CANFOR	Annually starting in 2012.
Declaration	Provide declaration of compliance and no penalties	Quota Holders	Annually starting in 2012

4.31 Indicator 31: % of temporary road (km) within cutblocks deactivated satisfactorily within 6 months following end of usage.

This indicator meets Alberta objective 3.1.1.1.

What does this indicator mean?

DOES LOGGING ROAD RECLAMATION OCCUR IMMEDIATELY AFTER USE?
DO WE PROTECT WATER QUALITY AND SOIL PRODUCTIVITY?

This indicator will track the proportion (%) of internal cutblock temporary roads reclaimed satisfactory by 6-months following end of their useful life. End of road life is normally defined as completion of log removal and any secondary processing of wood-debris, at final clearance of the operational stage of the harvest. It provides a measure of progressive company efforts to prevent erosion or other long-term impacts in forest recovery, vegetation growth-rates and soil productivity within cutblocks by initiating undelayed restoration activities.

TARGET

100% (as set by company policy)

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is exceeded?

Deactivate ASAP
Adjust Practices to prevent occurence

Current Status and Forecasted Targets/Thresholds of Indicator

Not Implemented Yet

% of temporary road (km) within cutblocks deactivated satisfactorily within 6 months following end of usage				
Tenure Holder	**% road deactivated within 6 months**	**Forecasted Target**	**Variance (%)**	**Achieve Target by**
DMI	0	100%	0	Immediately
CANFOR	0	100%	0	Immediately
Tolko		0	0	
Seehta Forest Products		0	0	
Zavisha Sawmill		0	0	
Boucher Bros. Sawmill		0	0	
Buchanan		0	0	
1113341 Alberta Ltd.		0	0	

*Current status based on operational data (if available).

Rationale for variance:

Not Implemented Yet

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Compliance Audit	Document findings and report accordingly.	DMI/CANFOR	Annually starting in 2012.
Declaration	Provide declaration of compliance and no penalties	Quota Holders	Annually starting in 2012

4.32 Indicator 32: Annual number of reportable spills by company

This indicator meets Alberta objective 3.2.2.1.

What does this indicator mean?

ARE POLLUTION & SPILLS PREVENTED SUCCESSFULLY?
DO WE PROTECT WATER QUALITY AND SOIL PRODUCTIVITY?

This performance indicator will track the annual number of accidental spills of hazardous materials during forest operations, for any spills that are of a reportable gravity. It reveals the quality of company controls, staff training, and operational monitoring to prevent serious spills that risk damage to soil ecosystems and their productivity.

TARGET

Zero (0) Alberta Environment Reportable Spills

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is exceeded?

DMI incident Tracking
Immediate Site Remediation
Adjust Practices
Regulatory Action may occur

Current Status and Forecasted Targets/Thresholds of Indicator

Annual number of reportable spills by company				
Tenure Holder	**# of AB Env Reportable Spills**	**Forecasted Target**	**Variance (%)**	**Achieve Target by**

DMI	0	0	0	Immediately
CANFOR	0	0	0	Immediately
Tolko		0	0	
Seehta Forest Products		0	0	
Zavisha Sawmill		0	0	
Boucher Bros. Sawmill		0	0	
Buchanan		0	0	
1113341 Alberta Ltd.		0	0	

*Current status based on operational data (if available).

Rationale for variance:

No Variance

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Compliance Audit	Document findings and report accordingly.	DMI/CANFOR	Annually starting in 2012.
Declaration	Provide declaration of compliance and no penalties	Quota Holders	Annually starting in 2012

4.33 Indicator 33: Annual Percentage of temporary crossings that meet all standards

This indicator meets Alberta objective 3.2.2.1. and objective 1.1.2.3.

What does this indicator mean?

DO COMPANY STREAM CROSSINGS MEET REGULATIONS?
IS WATER QUALITY PROTECTED?

This performance indicator will track the annual proportion (%) of temporary watercourse crossings that meet the standards identified by various regulatory sources. The quality of company controls, workforce training and operational monitoring will be evident in this indicator that reveals the implementation of existing standards of protection during installation, maintenance, timely removal and reclamation of such crossings.

TARGET

100% (as set by company policy)

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is exceeded?

DMI Incident Tracking Triggered
Immediate Site Remediation
Regulatory Action may occur
Adjust Practices

Current Status and Forecasted Targets/Thresholds of Indicator

Annual Percentage of temporary crossings that meet all standards				
Tenure Holder	**% Crossings Meeting Standards**	**Forecasted Target**	**Variance (%)**	**Achieve Target by**
DMI	100%	100%	0	Immediately

CANFOR	100%	0	0	Immediately
Tolko		0	0	
Seehta Forest Products		0	0	
Zavisha Sawmill		0	0	
Boucher Bros. Sawmill		0	0	
Buchanan		0	0	
1113341 Alberta Ltd.		0	0	

*Current status based on operational data (if available).

Rationale for variance:

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Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Compliance Audit	Document findings and report accordingly.	DMI/CANFOR	Annually
Declaration	Provide declaration of compliance and no penalties	Quota Holders	Annually starting in 2012

4.34 Indicator 34: Annual Percentage of active permanent crossings inspected

This indicator meets Alberta objective 1.1.2.3.

What does this indicator mean?

IS WATER QUALITY PROTECTED?

This performance indicator will track the proportion (%) of permanent watercourse crossings that are inspected annually.

Water quality can be influenced by the maintenance practices utilized for permanent bridge crossings. These crossings are a necessary part of all-weather roads that support long-term forest operations. Inspection of permanent bridge structures is beneficial for safety, protection of company investment, and protection of riparian area at the crossing site (bank, bed, channels, riparian and aquatic habitat).

TARGET

100% of bridge crossings inspected in 2 year period.

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is exceeded?

Management Review
Perform outstanding Inspections
Adjust Practices

Current Status and Forecasted Targets/Thresholds of Indicator

Disposition	Road Name	Location	Legal	Previous Inpsection(s)	Target	Variance	Achieve Target By

Disposition	Road Name	Location	Legal	Previous Inpsection(s)	Target	Variance	Achieve Target By
LOC 001150	South Notikewan Road	Unnamed trib. To Notikewan River	08-23-90-03 - W5M	2007, 2009	100% over 2 yrs	0	
MD road	P5-100: East Haul Road	Km.18 First Cadotte	16-03-87-19-W5M	2005, 2007, 2008	100% over 2 yrs	0	
LOC 920770	P5-100: East Haul Road	Km.56 WhiskeyJack Creek	10-23-90-20-W5M	2007, 2009	100% over 2 yrs	0	
LOC 981731	P5-100: East Haul Road	Km. 76 unnamed trib. To Peace River	02-19-92-19-W5M	2005, 2007, 2009	100% over 2 yrs	0	
LOC 981731	P5-100: East Haul Road	Km. 85 Keppler Creek	01-10-93-19-W5M	2005, 2007, 2009	100% over 2 yrs	0	
LOC 982540	P5-100: East Haul Road	Km. 108 Chester Creek	16-36-94-18-W5M	2007, 2009	100% over 2 yrs	0	
LOC 982540	P5-100: East Haul Road	Km. 116 Cache Creek	12-32-95-17-W5M	2007, 2009	100% over 2 yrs	0	
LOC 982540	P5-100: East Haul Road	Km. 118 unnamed tributary to Cache Crk	1-5-96-17-W5M	2006, 2008	100% over 2 yrs	0	
LOC 982540	P5-100: East Haul Road	Km. 124 Buhler Creek	7-14-96-17-W5M	2006, 2008	100% over 2 yrs	0	
LOC 032031	P5-100: East Haul Road	Km. 138 Wolverine River	10-22-97-16-W5M	2006, 2008	100% over 2 yrs	0	
LOC 032031	P5-100: East Haul Road	Km. 155 Buffalo River	2-33-98-16-W5M	2006, 2008	100% over 2 yrs	0	
LOC 012169	P5-100: East Haul Road	Km. 159 Moose Creek	11-3-99-16-W5M	2006, 2008	100% over 2 yrs	0	
LOC 012169	P5-100: East Haul Road	Km.168 Beaver Creek	1-3-100-16-W5M	2006, 2008	100% over 2 yrs	0	

Disposition	Road Name	Location	Legal	Previous Inpsection(s)	Target	Variance	Achieve Target By
LOC 012169	P5-100: East Haul Road	Km.174.5 Otter Creek	6-22-100-16-W5M	2006, 2008	100% over 2 yrs	0	
LOC 032031	P5-100: East Haul Road	Km. 138.9 unnamed trib. to Wolverine River	3-22-97-16-W5M	2007, 2008	100% over 2 yrs	0	
LOC 032031	P5-100: East Haul Road	Km.131.75 unnamed trib. To Buhler Creek	9-1-97-17-W5M	2007, 2008	100% over 2 yrs	0	
LOC 032031	P5-100: East Haul Road	Km.142.8 unnamed trib. to Wolverine River	5-35-97-16-W5M	2007, 2008	100% over 2 yrs	0	
LOC 900652	P10-100: Keg River Road	Km 2 unnamed trib. To Keg River	02-24-101-25-W5M	2007, 2009	100% over 2 yrs	0	

*Current status based on operational data (if available).

Rationale for variance:

No variance

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Develop Bridge Inspection Report	Standardized report in Discoverer	Oracle Analyst	1 yr
Analysis	Summarize annual inspection data	Landuse Coordinator	Annually

Report	Indicator report		Annually

4.35 Indicator 35

This number is not used.

4.36 Indicator 36: Annual percentage of inspected crossings that achieve a low SCQI index rating

This indicator meets Alberta objective 3.2.2.1.and objective 1.1.2.3.

What does this indicator mean?

WHEN MANAGING STREAM CROSSINGS, HAVE WE DONE THE RIGHT THING IN THE RIGHT PLACE TO PROTECT WATER QUALITY?

This indicator will track the proportion (%) of inspected watercourse crossings that are found to have a low risk rating for erosion or sedimentation risks. Low risk ratings reflect the quality of company workforce training, reclamation scheduling and management controls to protect watercourses through timely and effective reclamation of stream crossings. The principle is that water quality can be influenced by diligence in monitoring and responsiveness to achieve effective vegetation recovery and prevent soil erosion through various engineering practices.

TARGET

100%

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is exceeded?

DMI Incident Tracking Triggered
Immediate Site Remediation
Regulatory Action may occur
Adjust Practices

Current Status and Forecasted Targets/Thresholds of Indicator

Not Implemented Yet

Annual percentage of inspected crossings that achieve a low SCQI index rating				
Tenure Holder	**% Crossings Meeting Standards**	**Forecasted Target**	**Variance (%)**	**Achieve Target by**
DMI	N/A	100%	0	2012
CANFOR	N/A	0	0	2012
Tolko		0	0	
Seehta Forest Products		0	0	
Zavisha Sawmill		0	0	
Boucher Bros. Sawmill		0	0	
Buchanan		0	0	
1113341 Alberta Ltd.		0	0	

*Current status based on operational data (if available).

Rationale for variance:

Not Implemented Yet

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Annual Inspections	Document findings and report accordingly.	DMI/CANFOR	Annually starting in 2012
Compliance Audit	Document findings and report accordingly.	DMI/CANFOR	Annually starting in 2012

Declaration	Provide declaration of compliance and no penalties	Quota Holders	Annually starting in 2012

4.37 Indicator 37: % of sampled blocks with buffers in place as required by government

This indicator meets Alberta objective 3.2.2.1.

What does this indicator mean?

ARE INDUSTRY OPERATIONS KEPT AWAY FROM WATER?

This performance indicator will track the proportion (%) of the blocks sampled during annual audits that have adequate stream, waterbody and wetland buffers intact. The quality of a company's system of planning and operational monitoring will be reflected in this indicator considering the various buffer types and buffer sizes (distances) required to protect water resources.

TARGET

100% (as set by government regulation)

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is exceeded?

DMI Incident Tracking Triggered
Immediate Site Remediation
Regulatory Action may occur
Adjust Practices

Current Status and Forecasted Targets/Thresholds of Indicator

% of sampled blocks with buffers in place as required by government

Tenure Holder	% Blocks Meeting Standards	Forecasted Target	Variance (%)	Achieve Target by
DMI	100%	100%	0	Immediately
CANFOR	100%	100%	0	Immediately
Tolko		0	0	
Seehta Forest Products		0	0	
Zavisha Sawmill		0	0	
Boucher Bros. Sawmill		0	0	
Buchanan		0	0	
1113341 Alberta Ltd.		0	0	

*Current status based on operational data (if available).

Rationale for variance:

No variance

Indicator Monitoring Plans

Inventory	Source	Updating required for future	Date / interval required
Block plans	Each Tenure Holder	No	Annual
Block harvest inspection reports	Each Tenure Holder	Yes	Annual
Declaration	Provide declaration of compliance and no penalties	Quota Holders	Annually starting in 2011

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Compliance Audit	Document findings and report accordingly.	DMI/CANFOR	Annually starting in 2012.

4.38 Indicator 38: % sampled blocks with no harvest area located within incised valleys or on slumping soils

This indicator meets Alberta objective 3.1.1.2.

What does this indicator mean?

ARE SENSITIVE VALLEYS AND UNSTABLE SLOPES PROTECTED?

This indicator will track the annual proportion (%) of sampled harvest blocks that contain no harvested land area within steep valleys or other areas of naturally slumping soils. This will demonstrate company forest management efforts to prevent operational impacts to water quality as well as ensure the conservation of the sensitive boreal landscape features.

TARGET

100%

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is exceeded?

DMI Incident Tracking Triggered
Immediate Site Remediation
Regulatory Action may occur
Adjust Practices

Current Status and Forecasted Targets/Thresholds of Indicator

% sampled blocks with no harvest area located within incised valleys or on slumping soils

Tenure Holder	% Blocks Meeting Standards	Forecasted Target	Variance (%)	Achieve Target by
DMI	100%	100%	0	Immediately
CANFOR	100%	100%	0	Immediately
Tolko		0	0	
Seehta Forest Products		0	0	
Zavisha Sawmill		0	0	
Boucher Bros. Sawmill		0	0	
Buchanan		0	0	
1113341 Alberta Ltd.		0	0	

*Current status based on operational data (if available).

Rationale for variance:

No Variance

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Compliance Audit	Document findings and report accordingly.	DMI/CANFOR	Annually starting in 2012.
Declaration	Provide declaration of compliance and no penalties	Quota Holders	Annually starting in 2012

4.39 Indicator 39: Periodic ECA value by PFRA Watershed

This indicator meets Alberta objective 3.2.2.1. This indicator is one of the biodiversity indicators for which Alberta is responsible.

What does this indicator mean?

IS WATER QUANTITY MANAGED?

This indicator will track periodic Equivalent Clearcut Area (hectares) per 10-year increment for each PFRA-defined watershed (geographic area). Only those portions of the watersheds within the FMAs will be considered. This indicator will demonstrate strategic company forest management controls to limit the amount of new forest clearings that might contribute to temporary water quantity increases in streams and rivers. The threshold points are the best available surrogates guiding prevention of extreme increases in water run-off quantity.

TARGET

Each PFRA watershed selected will be less than 30% ECA at any point in time.

What Is the Allowed Variance From the Target?

Zero (0)

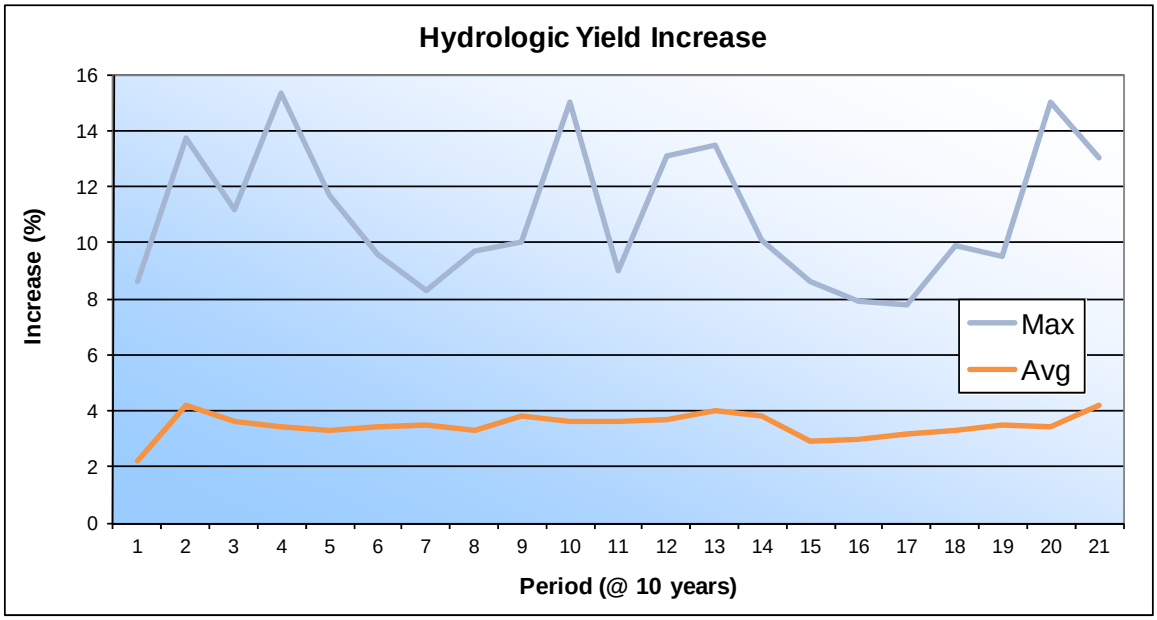
What Happens If Allowed Variance is exceeded?

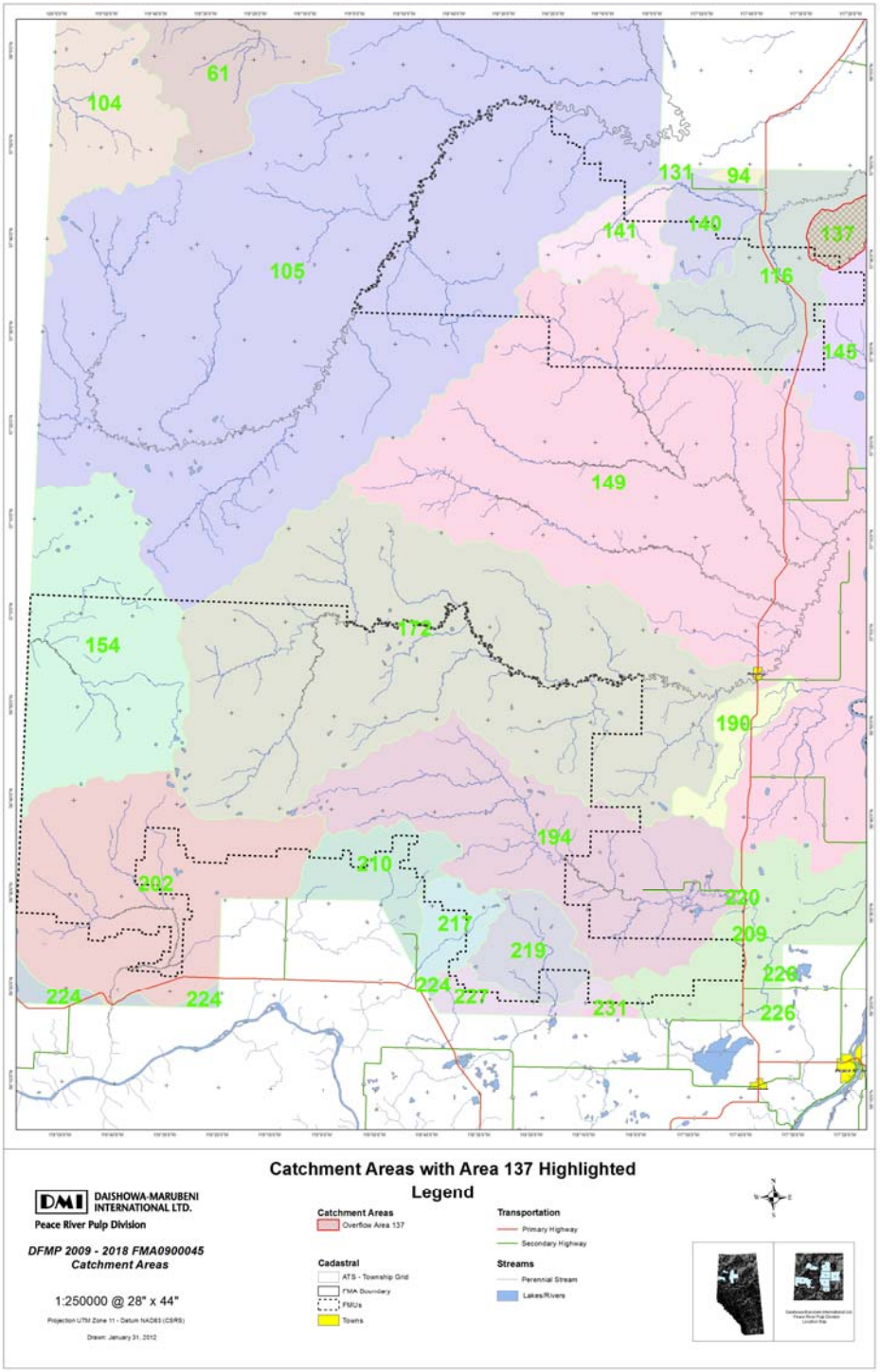
Additional operational planning considerations will be required in final harvest plans
Adjust next DFMP

Current Status and Forecasted Targets/Thresholds of Indicator

The timber supply model was constrained to allow no more than 15% hydrologic yield increase in each watershed catchment. The following graph shows the average hydrologic yield increase across P19 and the maximum value across the

whole forest. The 15% constraint was broken in period 3 with a value of 15.3% in catchment 137 (the second smallest catchment).





Map 17. PRFA watershed catchments used in the ECA calculation for FMA 0900045.

Rationale for variance:

This analysis forms the baseline for future comparison. Following the spatial harvest sequence should ensure that actual results will not vary. The very small variance (0.3%) in catchment 137 is explained by the fact that catchment 137 is mostly outside of the FMA. A very small portion of the total watershed actually contributes to the analysis. In the real world, the FMA harvest will contribute less than 15.3% to the whole watershed.

Indicator Monitoring Plans

DMI will work co-operatively with ASRD during the 100 day review period of this plan to finalize this analysis. The TSA has incorporated ECA for Alberta to accept in place of their own analysis.

The actual calculated ECA will be compared to the forecast ECA every five years. Adjustments will be made to future operational sequencing to react to any variances found.

4.40 Indicator 40: CBM Model Output

This indicator addresses CSA element 4.1. It is not required at this time for approval of the DFMP.

What does this indicator mean?

WILL THE FOREST CONTINUE TO CAPTURE CARBON?

This indicator will track the amount of atmospheric carbon captured by the forest as calculated by the Canadian Forest Service model CBM-CFS3 (v1.2) and reported in 10-year increments. This indicator will demonstrate the value of sustainable forest management in facilitating landscape scale absorption of carbon from the atmosphere and enabling its long-term sequestration in wood products.
enough to start accumulating volume, will remove carbon from the atmosphere.

TARGET

2009 levels as determined in the DFMP 2009-2018.

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is exceeded?

Adjust next DFMP.

Current Status and Forecasted Targets/Thresholds of Indicator

Current Status	Forecasted Target	Variance	Achieve Target by
PENDING			

Rationale for variance:

Not Implemented yet

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Acquire data	Prepare Woodstock stand inputs. Ensure net landbase calculation is current. Ensure CFS model is current version	DMI	2011
Analysis	Run CBM-CFS and Woodstock model inputs to calculate for 2 comparative scenarios: preferred and no-harvest.	DMI	2012
Report	Indicator performance management report	DMI	2012

4.41 Indicator 41: Quadrant Production by Company

This indicator meets Alberta objective 5.1.1.1.

What does this indicator mean?

IS THE HARVEST SUSTAINABLE?

The twenty-year term of FMAs are monitored by the government on a 5-year period known as a Quadrant. This indicator will track the quadrant production by company and highlight the use of their harvest allocations. The indicator shows that the harvests are contributing to sustainable communities.

Target

+/-10% Quadrant Cut (by species and by company)

What Is the Allowed Variance From the Target?

The allowable variance for a quadrant is plus or minus 10% as set by the government. Harvest volume above or beyond 10% at the end of the quadrant is considered to be variance.

What Happens If Allowed Variance is Exceeded?

If the allowed variance is exceeded, adjustments are made to the following quadrant to either increase or decrease the periodic allowable harvest. Penalties for exceeding this allowed variance are also applied by the government to act as a deterrent.

Current Status and Forecasted Targets/Thresholds

Current Status:

FMA Production*

Deciduous Volume

Company	Quadrant		Quadrant Production (2009)		Variance**
	Volume (m3)	Period (yrs)	Vol (m3)	% Quadrant	
DMI	4,653,695	4.83	325,777	7%	
Total	***4,653,695***		***325,777***	***7%***	

Coniferous Volume

Company	Quadrant		Quadrant Production (2009)		Variance**
	Volume (m3)	Period (yrs)	Vol (m3)	% Quadrant	
DMI	565,582	4.83	103,293	18%	
Canfor		4.83			
Zavisha		4.83			
Tolko		4.83			
Boucher Bros.		4.83			
Buchanon		4.83			
Seehta		4.83			
1113341 Alberta		4.83			
Total	***565,582***		***103,293***	***18%***	

**Combined production of FMA0900044 and FMA0900045*

***Variance is calculated at end of Quadrant period.*

Rationale for variance:

Variance will be determined at the end of the quadrant that occurs on April 30th, 2014.

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions Required	Responsibility	Schedule (date/interval)
Report volumes to TPRS	Determine product by volume and report to the ASRD Timber Product Reporting System.	Destination company	Monthly, quarterly, annual Final reports due May 31 annually.

4.42 Indicator 42: Number of opportunities for stakeholders and public to provide input. + Number of identified issues actioned within 30 days

This indicator meets Alberta objective 5.2.2.1.

What does this indicator mean?

DID WE CONSULT OUR STAKEHOLDERS?

This indicator will show the number of opportunities provided to our stakeholders to have input into the management of our forest and will be measured based on the number of meetings held with our Public Advisory Committee (PAC) each year.

Discussions with various stakeholders ensure companies are aware of their values and concerns. Stakeholder values are then considered in developing forest plans and then considered for incorporation where feasible.

What Is the Allowed Variance From the Target?

The minimum number of meetings is set at a minimum of four per year with no allowance for variance.

What Happens If Allowed Variance is Exceeded?

If there is a variance, the process will be evaluated to ensure it remains effective to the members of the PAC. If the PAC indicates improvements are required, steps will be taken to modify the process accordingly.

Target:

>= 4 Public Advisory Committee meetings per Year

Current Status and Forecasted Targets/Thresholds of Indicator

There have been 32 public advisory committee meetings since 2006.

Current Status:2010

Company	Type				Target	Variance	Target Timing
	DFMP	GDP	Other	Total			
DMI	8	10	4	22	4	None	Annual
Canfor					4	4	
Zavisha					4	4	
Tolko					4	4	
Boucher Bros.					4	4	
Buchanon					4	4	
Seehta					4	4	
1113341 Alberta					4	4	
Total	8	10	4	22			

GDP: Annual presentation of GDP to Town Councils, Municipalies and general public.
DFMP: Public Advisory Committee meetings and Open Houses for the general public.
Other: Miscellaneous meetings with trappers, recreation groups, researchers, etc.

Rationale for variance:

No variance

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions Required	Responsibility	Schedule (date/interval)
Maintain communications records.	Keep copies and/or electronic files for communications and report summary	Companies	Annual

4.43 Indicator 43: Annual direct and indirect employment levels by company

This is a voluntary CSA indicator.

What does this indicator mean?

DOES THE COMPANY PROVIDE SOCIAL/ECONOMIC BENEFITS TO THE COMMUNITY?

This indicator will track per company the annual level of forest company employment including both; 1. direct staff levels, and 2. indirect workforce (contractors, consultants, support industry). The societal benefit of collective human resources employed by the local forest sector demonstrates one measure of contribution to community stability through sustainable forest management efforts.

TARGET:

Stable workforce relative to 2009 baseline (To be finalized by 2012)

What is the Allowed Variance From the Target?

Target must be achieved within 20% of 2009 baseline or exceeded (suggestion to be finalized).

What happens if Allowed Variance is Exceeded?

Evaluate factors in markets, business costs, government policy, and business practices to identify root cause(s) for workforce decline. Adjust business-plan strategies in subsequent 5-year business plans as an action plan to maintain business viability and contribute to community stability.

Current Status of Indicator

Company	Direct Workforce Population	Indirect Workforce -Forest Business	Indirect Workforce -Milling Business

	Mill Facility	Woodlands	Operations Contractors	Consulting Professional	Contractors	Consulting Professional
DMI	239.11 perm 22.76 temp	42 perm 1.99 temp	371	101	23.82	7
Canfor						
Tolko						
Zavisha						

Rationale for variance:

N/A (this is a baseline report)

Indicator Monitoring Plans

Inventories Needed to Monitor and Analyze Indicator

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Acquire data	Gather direct employee count Survey to gather indirect employment	All DFA companies All DFA companies	Annual starting in 2012
Analysis	Compile inputs to single report. Evaluate changes. (gravity, cause)	DMI	Annual starting in 2012
Report	Indicator performance management report Business plan strategy adjustment if necessary	DMI All DFA companies	Annual starting in 2012

4.44 Indicator 44: Reforestation Standards productivity forecast by company

This indicator meets Alberta 5.2.3.1.

What does this indicator mean?

DO WE MAINTAIN LONG TERM TIMBER PRODUCTIVITY?

This indicator will track the productivity of regenerating cut blocks.

Maintaining a long term sustainable wood supply is both a business goal and a determining factor in community economic health and societal benefits. Sustainable Forest Management strives to ensure that the forest land base remains healthy, productive and able to generate a long-term stable timber supply in tandem with non-timber values.

TARGET

The target productivity level is equal to or greater than 2009 DFMP forecast.

Prior to 2010, performance surveys consisted of the presence or absence of a crop tree in small plots evenly spaced across the entire block. Regeneration success was reported as ‘satisfactorily restocked’ (SR) if 80% or more of the plots contained a crop tree or ‘not satisfactorily restocked’ (NSR) if less than 80% of the plots contained a crop tree. These surveys were done when the cut block was between 8-14 years of age, with mandatory reporting by year 14. There was no actual measure of productivity; only stocking. See Indicator 23 for results of these surveys.

In 2010, the regeneration survey process was revised by the government to provide for a measure of productivity between the ages of 12-14 using the average annual growth rate in cubic meters per hectare per year. This is termed the Mean Annual Increment, or MAI. Because this measure of productivity is only currently being implemented, there is no data to present. Details of the new process are contained within the manual Regeneration Standards of Alberta, June 2010 (RSA).

What Is the Allowed Variance From the Target?

Zero (0)

What Happens If Allowed Variance is exceeded?

AAC adjustment

Adjust next DFMP

Current Status and Forecasted Targets/Thresholds of Indicator

Not Implemented Yet

Productivity of Harvested Area for the Year 2009				
Tenure Holder	**Actual MAI**	**Forecasted Target**	**Variance**	**Achieve Target by**
DMI	Not available	Not available		

Rationale for variance

There is no variance to report

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Set MAI targets	Complete DFMP timber supply analysis	DMI	2011

Determine MAI of regenerating cut blocks	Complete Performance Surveys, compile data, and use GYPSY to calculate MAI	Companies	Every 2-3 years, as cut blocks reach 12-14 years of age

4.45 Indicator 45: Annual number of Aboriginal consultation opportunities by company. Annual number of early and effective opportunities for consultation with Aboriginal communities by company.

This is a voluntary CSA indicator.

What does this indicator mean?

DID WE MAKE EFFORTS TO PROVIDE MEANINGFUL CONSULTATION OPPORTUNITIES WITH ABORIGINAL GROUPS?

This indicator will track the annual number of opportunities offered per company for information exchange, relationship building and/or consultation with Aboriginal communities or their representatives.

Consultation and exchange of information with Aboriginal communities helps to ensure that companies are aware of their values. Their participation in the planning process provides a way to ensure their values are respected, considered in developing forest plans and incorporated where possible.

Frequency of interaction will vary, and is largely determined by the willingness and/or capacity of the Aboriginal communities to participate.

Target:

>= 2 communications per Aboriginal Group per GDP per Year

What Is the Allowed Variance From the Target?

A variance would occur if one of the companies (or groups of companies) has less than 2 communications with the required Aboriginal Communities in any one year. As this level of communication is a requirement, variances are not acceptable under normal situations. However, in situations where communication is not possible with an Aboriginal community, ASRD will be consulted for guidance on appropriate measures to be taken.

What Happens If Allowed Variance is Exceeded?

If there is a variance, the company or companies may not receive the approval to operate on the FMA

Current Status and Forecasted Targets/Thresholds of Indicator

Current Status:

Summary of Consultation Opportunities

Company	2009	Target >=	Variance	Target Timing
DMI	22	16	None	Annual
Canfor	6	4	None	Annual
Zavisha	0	4	-4	Annual
Tolko	18	16	None	Annual
Boucher Bros.	0	12	-12	Annual
Buchanon	0	12	-12	Annual
Seehta	0	12	-12	Annual
1113341 Alberta	0	12	-12	Annual
Total	46	88	-42	

Rationale for variance:

There is no variance for DMI, Canfor and Tolko; these companies consulted as a group.

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions Required	Responsibility	Schedule (date/interval)
Maintain communications records.	Keep copies and/or electronic files for communications	Companies	Annual

	and report on them		

4.46 Indicator 46: Number of identified Aboriginal values directly addressed in DFMP and annual plans.

This is a voluntary CSA indicator.

What does this indicator mean?

ARE THINGS OF IMPORTANCE TO ABORIGINAL PEOPLES CONSIDERED AND REFLECTED IN FOREST PLANS?

This indicator will report both the annual number of values expressed by local Aboriginal communities to individual companies during dialogue, and the number of those inputs (values, knowledge) that can and which have been addressed within strategic management plans or annual operational plans (roads, harvesting). This indicator reveals the outcome of pro-active outreach to Aboriginal peoples in seeking input on forest planning and more importantly company responsiveness in incorporating that input into plans wherever possible within the scope of the Company's management control. The level of integration of Aboriginal values is demonstrated by this indicator.

TARGET:

100% of within-scope values are incorporated into standing plans and processes, or have action-plans for future adoption.

What is the Allowed Variance From the Target?

Target must be achieved except for values that are out-of-scope (those that are outside the authority or viability of a private company to resolve).

What happens if Allowed Variance is Exceeded?

Develop a statement of rationale describing the value, why it has/has not been incorporated into strategic plans or operational practices, and an action plan to attempt to mitigate impacts if it has not. Evaluate out-of-scope values for potential to offer cooperative assistance outside the scope of FMP process. Communicate the decisions to the originating sources and to government.

Current Status of Indicator

DMI CONSULTATION DATA:

Aboriginal Values identified 2007-2010 consultations (number to Feb 25)	CSA/CCFM Criterion Category	Aboriginal Values addressed in DMI plans (DFMP, FHP)	Aboriginal Values not addressed in DMI planning
11	1 –Biodiversity Conservation	3 –YES	7 –OS 1- GAP
2	2 –Ecosystem Health	0	1 –OS 1 -GAP
3	3 –Soil & Water Conservation	2 –YES	1 –OS
0	4 –Ecosystem Contributions to Global Ecology		
32	5 –Forest Benefits to Society	9 –YES	6 –OS 15 –GAP 2 –NO
21	6 –Forest Management Decisions (Participation)	5 -YES	8 –OS 8 –GAP
69	**TOTAL**	**19-YES**	**23 –OS** **25 –GAP** **2 –NO**

Status categories:
Yes -addressed in DMI planning (DFMP, FHP)
OS -Out-of-scope (not within company mgt authority) -to communicate input to government
Gap -opportunity to evaluate & incorporate into DMI planning
No -evaluated and not to be incorporated into DMI planning

Rationale for variance:

There is no variance.

Indicator Monitoring Plans

Inventories Needed to Monitor and Analyze Indicator

Inventory	Source	Updating required for future analysis?	Date / interval required
Consultation records	All DFA companies ?	Yes	Annual
Unsolicited feedback (comment collection systems)	All DFA companies	Yes	Annual
Plans (DFMP, GDP, FHP)	All DFA companies	Yes	Annual

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Acquire data	Gather current-year's records of response (unsolicited & solicited)	All DFA companies	Annual
Analysis	Isolate out-of-scope value items. Evaluate remainder against existing plans (strategic, operational) Compile report inputs (O/S, Addressed, Gaps) Develop action-plans for unaddressed gaps.	All DFA companies All DFA companies DMI All DFA companies	Annual

Activity	Actions required	Responsibility	Schedule (date/interval)
Report	Indicator performance management report	DMI	Annual
	Management adjustment if necessary	All DFA companies	
	Communicate decisions (community, Ab Gov)	All DFA companies	

4.47 Indicator 47: Annual % score on PAC satisfaction survey

This is a voluntary CSA indicator.

What does this indicator mean?

DOES THE PAC PROCESS MEET THE EXPECTATIONS OF PAC MEMBERS?

This indicator shows whether the PAC process is satisfactory to the PAC participants.

A fundamental part of the CSA sustainable forest management framework is that public consultation must be meaningful. It is a requirement that the public be allowed to participate in a manner that works for the participants. This indicator gauges how well the process has worked.

TARGET

75% Satisfaction annually

What Is the Allowed Variance From the Target?

+/- 25%

What Happens If Allowed Variance is Exceeded?

If satisfaction falls below 50%, then there will be an immediate review of PAC TOR to remedy the situation.

Current Status and Forecasted Targets/Thresholds of Indicator

Current Status:

Rationale for variance:

This is a baseline establishment and not an update – therefore there is no variance at this time.

Indicator Monitoring Plans

Survey will be given to PAC at the last meeting of the calendar year.

Indicator Monitoring Implementation Schedule

Annual.

4.48 Indicator 49: Annual number of website visits with > 1 page hits

This is a voluntary CSA indicator.

What does this indicator mean?

IS CURRENT FOREST INFORMATION AVAILABLE ON COMPANY WEBSITES BEING ACCESSED BY THE PUBLIC?

This indicator will report the annual number of visits per each company website, and in particular those visits that show page hits greater than one-page. This reveals to a limited degree the quality of information posted to a website that is of interest to various public audiences. Visits of greater than a single-page suggest that the visitor was interested and searching for specific information or topics.

TARGET

Equal to or greater than 2009 number

What Is the Allowed Variance From the Target?

+/- 25% of 2008 level.

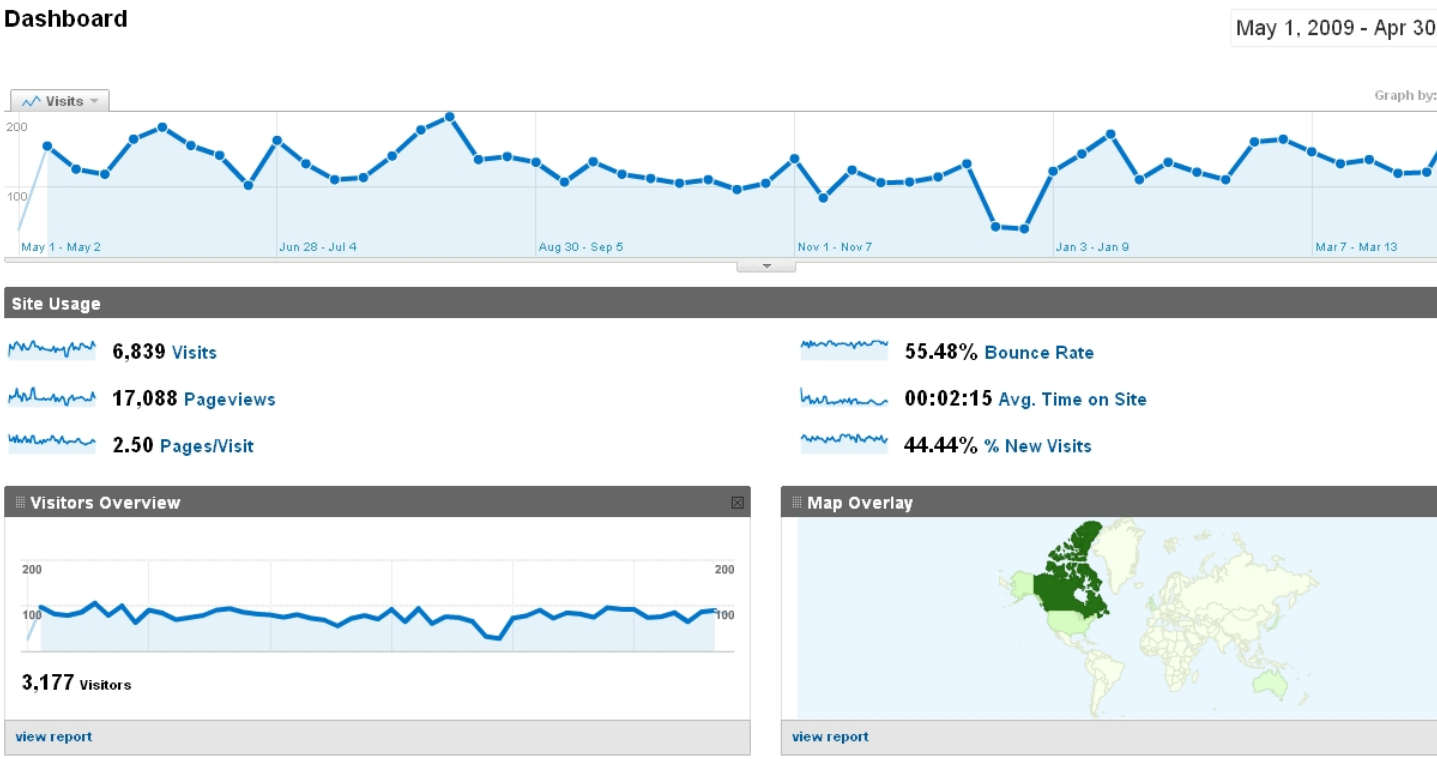
What Happens If Allowed Variance is exceeded?

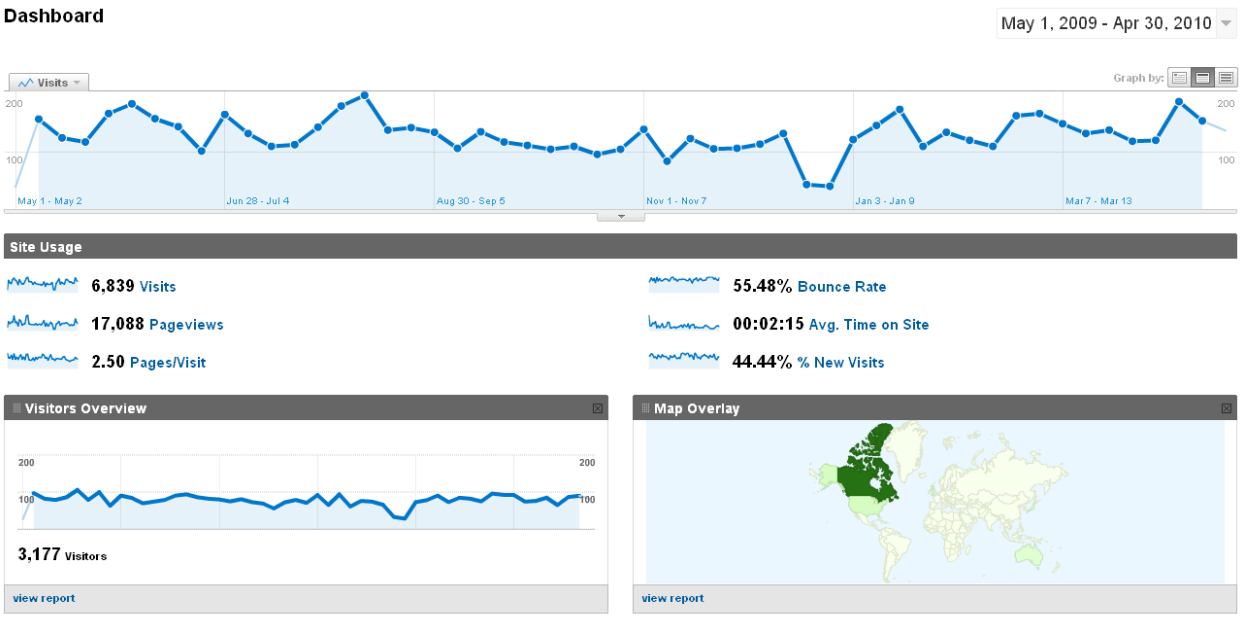
Review the need to change strategy

Current Status and Forecasted Targets/Thresholds of Indicator

DMI's approach to meeting this target relies on a tracking mechanism provided by Google Analytics. Each visit to the website is tracked into various settings including total page visits, page views, pages per visit, country of origin, specific pages, etc.

Annual number of website visits with > 1 page hits





*Current status based on operational data (if available).

*Current status based on operational data (if available).

Rationale for variance:

There is no variance at this time.

Indicator Analysis Information

Indicator Monitoring Plans

Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Analysis of page hits	N/A	Each tenure holder	Annual

5: Commitments

There are VOITs in the Alberta Planning Standard Annex4 table that are not directly and exactly covered in the DMI CSA certification. DMI and other companies following this DFMP commit to these actions for the purpose of Alberta forest management approvals. These particularly worded expectations from Alberta do not meet the rigor of CSA certification audits and are therefore separate from the VOIT section to avoid confusion.

The fact that these commitments are not included in the CSA Z809 certification do not diminish their importance nor the obligation from DMI to achieve them. They are separated here for administrative clarity only.

5.1 Commitment C1: Open All-Weather Road Density by Sub Unit

This indicator addresses Alberta Objective 1.1.1.3 a) – Minimize access to help landscape scale biodiversity.

5.1.1 What does this indicator mean?

ARE THE AMOUNT OF HIGH IMPACT ROADS INCREASING?

Open all weather roads have the potential to have negative impacts on wildlife. Minimizing the density of such roads should lessen the risk of negative impacts on wildlife.

5.1.2 TARGET

Less than or equal to the 2009 density in 2019.

5.1.3 What Is the Allowed Variance From the Target?

+/- 20% of 2009 density..

5.1.3.1 What Happens If Allowed Variance is exceeded?

Review the need to change strategy in next DFMP

5.1.4 Current Status and Forecasted Targets/Thresholds of Indicator

At the current time, we do not have an inventory of roads that meets the Alberta definition. Therefore a proxy will be used – the base features available. These include all roads by all users.

Table 7. Open all weather road density in FMA 0900045

FMA0900045 Open All-Weather Forestry Road Density January 2012									
FMU	Gross Area	2 - Lane Undivided Highway		High Grade Gravel		Low Grade Gravel		Truck Trail	
	(km^2)	Length (km)	Density (km/km^2)	Length (km)	Density (km/km^2)	Length (km)	Density (km/km^2)	Length (km)	Density (km/km^2)
VSA1	2852.39	27.80	0.01	3.33	0.00	53.50	0.02	406.13	0.14
VSA2	6840.85	0.00	0.00	239.14	0.03	366.34	0.05	657.90	0.10
TOTAL	9693.24	27.80	0.00	242.47	0.03	419.84	0.04	1064.03	0.11

5.1.4.1 Rationale for variance:

This a baseline determination. There is no variance at this time.

5.1.5 Indicator Analysis Information

This is a simple summation of known road features from the 2003 1:20,000 provincial base layer.

5.1.6 Indicator Monitoring Plans

This indicator will be reviewed in 2012 by DMI and ASRD. If deemed necessary, DMI will fine-tune the dataset to include the required information to meet the exact Alberta definition of 'open forestry' roads.

Whatever the final data product turns into, this indicator will be re-evaluated every five years and reported in the Stewardship Report.,

5.1.6.1 Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Review Indicator	ASRD request change if needed	ASRD / DMI	2012
5 year review	Update layer and run query - report	DMI	2014 Stewardship Report

5.2 Commitment C2: Open Seasonal Temporary Forestry Road Length

This indicator addresses Alberta Objective 1.1.1.3 b) – Minimize access to help landscape scale biodiversity.

5.2.1 What does this indicator mean?

ARE THE AMOUNT OF HIGH IMPACT ROADS INCREASING?

Open seasonal forestry roads have the potential to have negative impacts on wildlife. Minimizing the density of such roads should lessen the risk of negative impacts on wildlife.

5.2.2 TARGET

Less than or equal to the 2009 density in 2019.

5.2.3 What Is the Allowed Variance From the Target?

+/- 20% of 2009 density..

5.2.3.1 What Happens If Allowed Variance is exceeded?

Review the need to change strategy in next DFMP

5.2.4 Current Status and Forecasted Targets/Thresholds of Indicator

At the current time, we do not have an inventory of roads that meets the Alberta definition. Therefore a proxy will be used – the base features available. These include all roads by all users.

Table 8. Density of seasonal or temporary roads in FMA 0900045

FMA0900045 Open Seasonal or Temporary Forestry Road Density January 2012			
FMU	Gross Area	Seasonal or temporary	
	(km^2)	Length (km)	Density (km/km^2)
VSA1	2852.39	33.52	0.01
VSA2	6840.85	1043.20	0.15
TOTAL	9693.24	1076.72	0.11

5.2.4.1 Rationale for variance:

This a baseline determination. There is no variance at this time.

5.2.5 Indicator Analysis Information

This is a simple summation of known road features from the DMI internal operations planning layer.

5.2.6 Indicator Monitoring Plans

This indicator will be reviewed in 2012 by DMI and ASRD. If deemed necessary, DMI will fine-tune the dataset to include the required information to meet the exact Alberta definition of 'open forestry' roads.

Whatever the final data product turns into, this indicator will be re-evaluated every five years and reported in the Stewardship Report.,

5.2.6.1 Indicator Monitoring Implementation Schedule

Activity	Actions required	Responsibility	Schedule (date/interval)
Review Indicator	ASRD request change if needed	ASRD / DMI	2012
5 year review	Update layer and run query - report	DMI	2014 Stewardship Report

5.3 Area of uncommon plant communities within DFA

This indicator addresses Alberta Objective 1.1.1.4 – Maintain plant communities uncommon in DFA and province.

5.3.1 What does this indicator mean?

ARE KNOWN AREAS OF RARE OR SPECIAL PLANTS DECLINING?

An ongoing inventory of known areas of rare or uncommon plants would show whether they are being maintained.

5.3.2 TARGET

Equal to or greater than 2009 number

5.3.3 What Is the Allowed Variance From the Target?

0.

5.3.3.1 What Happens If Allowed Variance is exceeded?

Review the need to change strategy in next DFMP or alter field practices.

5.3.4 Commitment

When identified by Alberta, DMI will store known locations in the VCVF system and adjust field practices to maintain identified features.

DMI provides training material to staff and contractors to identify rare plants.

5.3.5 Current Status and Forecasted Targets/Thresholds of Indicator

To date, no areas or features have been identified by Alberta.

5.3.5.1 Rationale for variance:

There is no variance at this time.

5.3.6 Indicator Monitoring Plans

This indicator will be updated as notifications occur and reported every five years

in the Stewardship Report.

5.4 Commitment C4: Retain Area of Unsalvaged Burned Forest

This indicator addresses Alberta Objective 1.1.1.5 – Maintain area of unsalvaged burned forest.

A) Retain all live unburned green tree islands and patches recognizing timber condition, access, and non-timber needs

B) Compartment Scale: retain more than 10% of merchantable burned black trees in patches greater than 100ha

C) Harvest Area Scale: Retain 10% of merchantable burned black trees in patches 10-100ha

D) Harvest Area Scale: Retain 5% of merchantable burned black trees in small patches and single stems according to loggers choice

5.4.1 What does this indicator mean?

ARE THERE PATCHES OF NATURAL FOREST FIRE REMNANTS LEFT?

For companies not practicing large retention, this is the only strategy that will see natural structure left in 2nd growth stands.

For companies practicing the DMI 15% strategy as standard practice everywhere on the FMA, this target is not required.

5.4.2 TARGET

- 100% of live green tree islands within large burn salvage will be left.
- 10% or greater of the merchantable black trees will be left in patches 10-100ha in size.
- 10% or greater of the merchantable black trees will be left in patches larger than 100 ha in size.
- 5% or greater of the merchantable black trees will be left in single stems and small clumps.

5.4.3 What Is the Allowed Variance From the Target?

0

5.4.3.1 What Happens If Allowed Variance is exceeded?

Review the need to change strategy in subsequent AOP

5.4.4 Current Status and Forecasted Targets/Thresholds of Indicator

There have been no large scale salvage operations since 2009.

5.4.4.1 Rationale for variance:

There is no variance at this time.

5.4.5 Indicator Analysis Information

Maps of large scale events and harvest plans within the event will be compared. Tables and maps representing the indicator will be produced.

5.4.6 Indicator Monitoring Plans

This indicator will be monitored every five years by ASRD and the company operating the salvage area. Reports will be provided for the 5 year Stewardship Report.

5.5 Commitment C5: Retain Unsalvaged Blowdown in Areas of Blowdown

This indicator addresses Alberta Objective 1.1.1.5 b).

5.5.1 What does this indicator mean?

ARE THERE PATCHES OF NATURAL BLOWDOWN REMNANTS LEFT?

For companies not practicing large retention, this is the only strategy that will see natural structure left in 2nd growth stands.

For companies practicing the DMI 15% strategy as standard practice everywhere on the FMA, this target is not required.

5.5.2 TARGET

As Alberta has not defined details on this indicator, it is set in this DFMP arbitrarily at 5% of blow down salvage area will be left in retention.

5.5.3 What Is the Allowed Variance From the Target?

0

5.5.3.1 What Happens If Allowed Variance is exceeded?

Review the need to change strategy

5.5.4 Current Status and Forecasted Targets/Thresholds of Indicator

There are no large scale Blowdown events on the FMA at this time..

5.5.4.1 Rationale for variance:

There is no variance at this time.

5.5.5 Indicator Analysis Information

Maps of large scale events and harvest plans within the event will be compared. Tables and maps representing the indicator will be produced.

5.5.6 Indicator Monitoring Plans

This indicator will be monitored every five years by ASRD and the company operating the salvage area. Reports will be provided for the 5 year Stewardship Report.

5.6 Commitment C6: Comply with Ground Rules

This indicator addresses Alberta Objective 1.1.1.6 which is a commitment to follow ground rules concerning protection of riparian areas.

5.6.1 What does this indicator mean?

ARE COMPANIES FOLLOWING GROUND RULES MEANT TO PROTECT RIPARIAN AREAS ?

There are many layers of approvals and regulation that govern forest operations. All companies will comply with all applicable rules. DMI and Canfor will use a compliance audit to prove compliance. Annual summaries are completed and will be shared with SRD. Non-certified companies will provide a statement that they received no penalties as proof of compliance.

5.6.2 TARGET

100% compliance
No Penalties

5.6.3 What Is the Allowed Variance From the Target?

0

5.6.3.1 What Happens If Allowed Variance is exceeded?

Enforcement action
Change in AOP conditions

5.6.4 Current Status and Forecasted Targets/Thresholds of Indicator

All companies are in compliance.

5.6.4.1 Rationale for variance:

There is no variance at this time.

5.6.5 Indicator Monitoring Plans

Companies will track annually. Regular GDP and AOP discussions and disclosures will occur as per normal operations. Specific summary of compliance will be tracked annually and presented every five years in the Stewardship report.

5.7 Commitment C7: Have a Noxious Weed Program

This indicator addresses Alberta Objective 2.1.3.1. – Control non-native plant species by having a noxious weed program.

5.7.1 What does this indicator mean?

ARE COMPANIES DOING ANYTHING TO CONTROLL THE SPREAD OF NOXIOUS WEEDS?

The spread of noxious weeds poses the risk of displacing native biodiversity. This indicator shows that companies are taking actions to minimize the risk.

5.7.2 TARGET

All companies will comply with Directive 2001-06.

5.7.3 What Is the Allowed Variance From the Target?

0

5.7.3.1 What Happens If Allowed Variance is exceeded?

Enforcement action
Change in AOP approvals/conditions

5.7.4 Current Status and Forecasted Targets/Thresholds of Indicator

This is already a requirement of AOP approval. DMI annually summarizes actions in the GDP.

5.7.4.1 Rationale for variance:

There is no variance at this time.

5.7.5 Indicator Monitoring Plans

Each company's status on this indicator will be addressed as per business as usual in the AOP approval and GDP reporting process.

5.8 Commitment C8: Reduce Wildfire Threat Potential

This indicator addresses Alberta Objective 5.2.1.1 – Reduce wildfire threat potential.

This indicator is the responsibility of Alberta. DMI will assist Alberta as requested.

5.8.1 What does this indicator mean?

IS ALBERTA REDUCING WILDFIRE THREAT?

Reduced wildfire threat theoretically should produce more stable benefits to communities.

5.8.2 TARGET

a) % Reduction in hectares of extreme and high fire behaviour potential in FireSmart Community Zone
b) % Reduction in hectares of extreme and high fire behaviour potential on the DFA

5.8.3 What Is the Allowed Variance From the Target?

Unspecified – to be determined by Alberta

5.8.3.1 What Happens If Allowed Variance is exceeded?

Review the need to change strategy.
Adjust next DFMP

5.8.4 Current Status and Forecasted Targets/Thresholds of Indicator

Incomplete. To be completed during the Alberta 100 day review period.

5.8.4.1 Rationale for variance:

There is no variance at this time.

5.8.5 Indicator Analysis Information

To be completed by Alberta – explanation of modeling process.

5.8.6 Indicator Monitoring Plans

To be reviewed at next DFMP in 2019.

5.9 Consult 1st Nations at Community Level

This indicator addresses Alberta Objective 6.1.1.1

5.9.1 What does this indicator mean?

ARE FIRST NATIONS CONSULTED?

Alberta expresses a requirement that companies consult First Nations to the satisfaction of Alberta. This somewhat vague target is met here by a commitment to follow DFMP, GDP, and AOP consultation requirements.

5.9.2 TARGET

Achieve Alberta approvals on DFMP, GDP, AOP

5.9.3 What Is the Allowed Variance From the Target?

0

5.9.3.1 What Happens If Allowed Variance is exceeded?

No approvals for operation
Change consultation methods

5.9.4 Current Status and Forecasted Targets/Thresholds of Indicator

DMI and Canfor hold CSA certifications that show adequate consultation.

All companies have Alberta approvals on all aspects of operations.

5.9.4.1 Rationale for variance:

There is no variance at this time.

5.9.5 Indicator Monitoring Plans

The status of consultation efforts are summarized annually in the GDP.

A five year summary will be presented in the Stewardship Report.

5.10 Meet CSA Z809 Consultation Requirements

This indicator addresses Alberta Objective 6.2.1.1 – Implement a public involvement program.

5.10.1 What does this indicator mean?

DO THE COMPANIES MEANINGFULLY CONSULT THE PUBLIC?

This indicator is a restatement of several indicators already covered. The companies commit to following Alberta expectations on GDP and AOP public consultations – failure to do so will result in lack of approval for operations.

5.10.2 TARGET

Achieve Alberta approval on DFMP, GDP, AOP

5.10.3 What Is the Allowed Variance From the Target?

0

5.10.3.1 What Happens If Allowed Variance is exceeded?

Operations are not approved
Review the need to change strategy

5.10.4 Current Status and Forecasted Targets/Thresholds of Indicator

All companies are in full compliance. Canfor and DMI have CSA certification to prove it.

5.10.4.1 Rationale for variance:

There is no variance at this time.

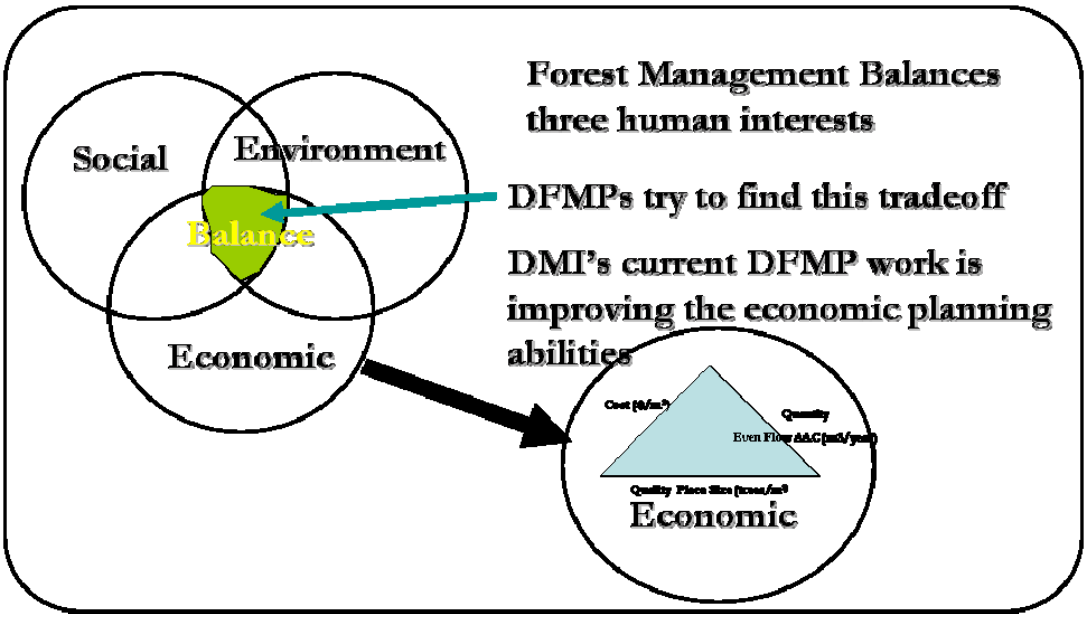
5.10.5 Indicator Monitoring Plans

This indicator will be reported on in the 5 year Stewardship Report.

6: Management Approach

The forecasting efforts presented here are primarily completed to assist the forest managers in making informed decisions that are aimed at producing pre-determined forest benefits. The recipient forest managers are making decisions that affect their business operations and the general state of the forest now and in the future. The unique combination of inputs and controls formulated here capture the composite decision making aspects identified through the VOIT process and business planning process.

This plan is an implementation of state-dependent planning. There are explicitly defined future forest state targets set in the model. There are explicitly stated predetermined business targets set (timber cost, quality, and quantity). Indirect control measures are also present – for example the core-contingency model used to manage timber cost and ensure non-timber sustainability.



6.1 Ecosystem Based Management

This plan is formulated to achieve the benefits of ecosystem-based management. The general concept is to proactively maintain forest structure in the managed

landscape similar to that of the natural landscape. This plan is the third evolution of the EBM approach by DMI. Like the previous two plans, DMI carries on here, implementing the basic components of EBM within its direct control:

- Maintain the building blocks of the natural forest at the landscape level
    - Achieved through landscape targets (BCGRP / Seral Stage combinations)
- Maintain a diversity of opening sizes and shapes
- Identify and protect special features
- Follow protective ground rules and use best practices
- Maintain natural structures at the stand level
    - Achieved through representative retention
    - Achieved through protective ground rules and best practices
- Practice Adaptive Management by directly funding research and monitoring

6.2 Business Management

This plan strongly ties strategic forest management to shorter term business management. Extensive efforts have been used to select a sequence of actions that meet business needs while also meeting the EBM needs.

The single largest focus is on balancing the timber supply's cost / quality / quantity. It is explicitly identified that Annual Allowable Cuts have a context founded in cost-quality-quantity combinations. Directly defining quantified targets addressing these three aspects will produce a sequence that will have a far greater chance of being implemented than strategic plans in the past.

6.2.1 Preschedule

DMI, Canfor, and Zavisha (3 out of 4 tenure holders within P19) chose to select 10 years of harvest blocks for prescheduling. All companies started with the spatial sequence from the 2007 DFMP and ground truthed their selections. Canfor and Zavisha significantly added to the pool of stands by identifying at-risk merchantable pine stands. In the end, the conifer preschedule constituted a surge cut that will capture the pine beetle at-risk stands before they die and become un-useable.

DMI selected a mix that included non-frozen operable ground and winter operable ground. All companies considered likely access for the next 10 years. The final preschedule represents a collection of blocks that have been vetted by their respective operators and confirmed to be merchantable and affordable.

It is the goal of the operators selecting the preschedule stands to have minimal variance over the first 10 years of the plan.

The modeling exercise amended the first round of picks to ensure sustainability.

Some blocks were moved to the 2nd ten year period.

Tolko opted to not pre-block. Their cut is relatively small concentrated in a relatively small area. The model picks a schedule of stands not unlike a manual selection would – there are not a huge array of options. Tolko will manage to the 20% variance allowance.

6.2.2 Core-Contingency

DMI and Quota Holders on FMA0900045 worked together to develop a new technique to deliver a strategic plan that identifies a wood supply that meets today's economic needs for cost, quality and quantity while also providing flexibility in reacting to changes in markets, operations and/or economic conditions that may arise in the future.

In keeping with ASRD's Forest Management Planning Standard, the Companies pre-blocked harvest areas for the first period (10 years) of the planning horizon based on considerations and trade-offs in cost, quality and quantity of the wood supply. Constraints were then incorporated into the timber supply model to reflect similar requirements for the development of sustained harvest levels. The wood supply was then determined for the combination of these two types of volume:

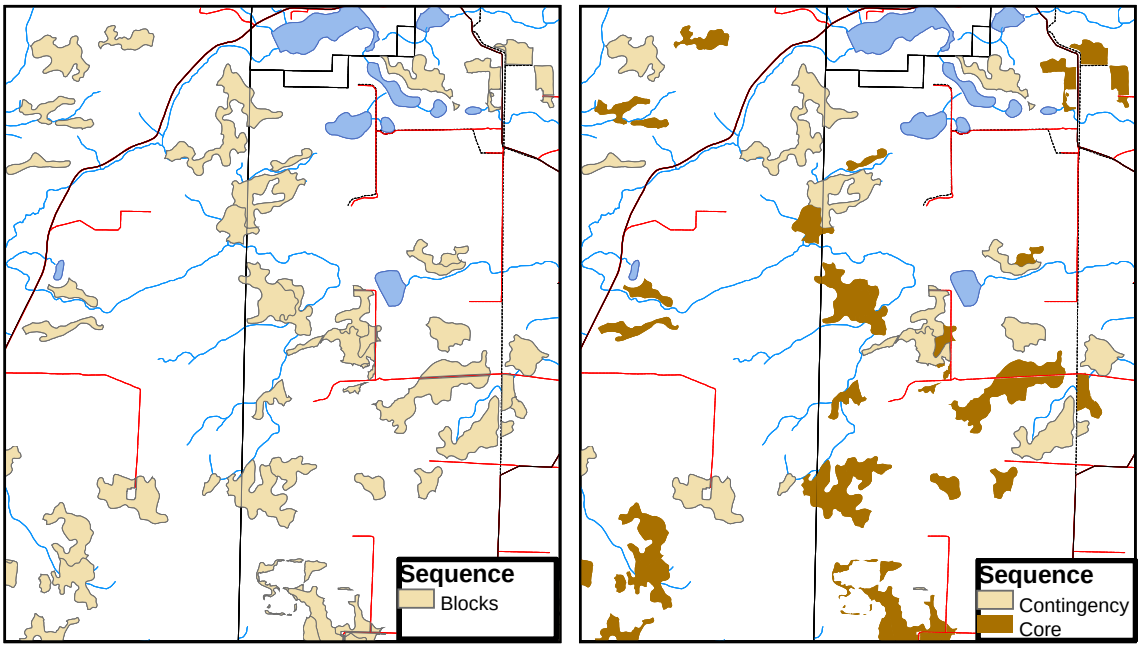
Core Supply: minimum sustainable volume supply meeting current acceptable levels for quality and cost and

Contingency Supply: additional sustainable volume supply meeting minimum quality and cost constraints that may be acceptable in some situations such as business hardships or during good economic conditions.

Application of this approach creates a Spatial Harvest Sequence (SHS) that identifies a sustainable Core supply of wood as well as a sustainable Contingency supply that is available when markets, operations and/or economic conditions identify a need for it. In addition to the benefits to the companies involved, the government is provided flexibility for the accommodation of future developments in the area such as the bio-energy sector through a sequenced contingency supply that is identified, approved and readily available for use.

As demonstrated in the figure below, the SHS developed using the core/contingency approach is essentially the same as what would be created from ASRD's standard process, but with Core and Contingency blocks identified. Since the Contingency supply is part of the AAC, it is always available for use, but if a need is not demonstrated by the FMA holder and/or the Quota Holders, the contingency wood could be made available to other users under permit.

The following points on the Core/Contingency concept are critical to its



Standard Spatial Harvest Sequence Core/Contingency Spatial Harvest Sequence

successful application within the scope of the Detailed Forest Management Plan.

- *Core supply* is a sustainable portion of the wood supply that provides the minimum amount of volume required by the companies at currently acceptable levels for cost (harvest, transport) and quality (piece size, height, volume per hectare) as defined by the companies. This may be further refined by adding considerations such as probability of social access.
- *Contingency supply* is the sustainable portion of the wood supply that meets minimum requirements for quality (piece size, height, volume per hectare) and is not Core. Thus contingency may be termed as the '*second choice*' of the total sustainable supply..
- The classification of stands as core or contingency is dynamic due to its relationship with volume and piece size that change as the stand ages, thereby allowing for the calculation of sustainable levels of each over the planning horizon identified in the DFMP.
- Core and contingency supplies for both conifer and deciduous volume are identified and sustained over the planning horizon identified in the DFMP. It is acceptable for a company to identify its entire FMU supply as being

either core or contingency or a mixture of both.

- The Annual Allowable Cut (AAC) calculated for the DFMP is the sum of the sustained harvest levels for core and contingency for both conifer and deciduous volume.
- The quadrant cut level for the FMA is the AAC x 5 years.
- The core and contingency blocks will be clearly identified within the Spatial Harvest Sequence (SHS) of the DFMP.
- Under the Core/Contingency approach, the requirements for variance reporting as defined in the Operating Ground Rules will be followed, but variance will be calculated separately for core and for contingency supplies. Rules surrounding variance limits of 20% and requirements for compartment analysis will be applicable to the core supply's associated variance only.
- The DMI Operating Ground Rules (under development) will detail the procedure for determination and reporting of variance in light of core and contingency and will reflect these points.
- The FMA holder has access to the contingency supply to the level identified by their percentage of the AAC, but also maintains control over the use of the contingency supply by companies external to the DFMP process. If an "outside" company requests access to a portion of the contingency supply and neither the FMA holder nor the QHs demonstrate the need for the supply in question, a permit to harvest a portion of the contingency supply may be provided through a permit under the FMA by the government with details agreed upon by ASRD and the FMA holder. A management fee may be applied against the permit holder by the FMA holder to recuperate FMA investments required for the development of the DFMP. Any "outside" company operating contingency blocks will follow all rules outlined in the DFMP and associated ground rules.
- The Quota holders have access to the contingency supply to the level identified by their percentage of the AAC as identified in their Quota. If an outside company wants access to a portion of the contingency supply and the QHs do not demonstrate a need for the volume, a permit to harvest a portion of the contingency volume may be provided by the government with details agreed upon by ASRD and the FMA holder. A management fee may be applied against the permit holder by the FMA holder to recuperate costs for FMA investments such as the development of the DFMP. Any "outside" company operating contingency blocks will follow all rules outlined in the DFMP and associated ground rules.
- Reporting of production in the GDP and stewardship report will be split out by core and contingency, but production numbers submitted to TPRS will be without categorization. Individual companies will track quadrant production by core/contingency and provide those numbers to the FMA holder annually to maintain a detailed accounting of the spatial harvest

sequence pool of blocks.

- Any company operating contingency blocks assumes all associated liabilities unless otherwise agreed to by ASRD and the Tenure holder that refused the volume.

6.3 Forest Certification

DMI operates under the following internationally recognized third party certifications:

- ISO 14001 Environmental Management System
- CSA Z809-02 Sustainable Forest Management
- FSC-STD-40-004 v2 Chain of Custody
- FSC-STD-40-005 v2.1 Chain of Custody
- PEFC/01-4-07 Chain of Custody

The rigorous auditing and reporting requirements of these management systems provides a very detailed and third party verified accounting of the targets achieved and actions that will be performed in the implementation of this DFMP.

Canfor and Tolko also hold ISO14001 and CSA Z809 certifications. Zavisha Sawmills is currently seeking ISO14001 certification.

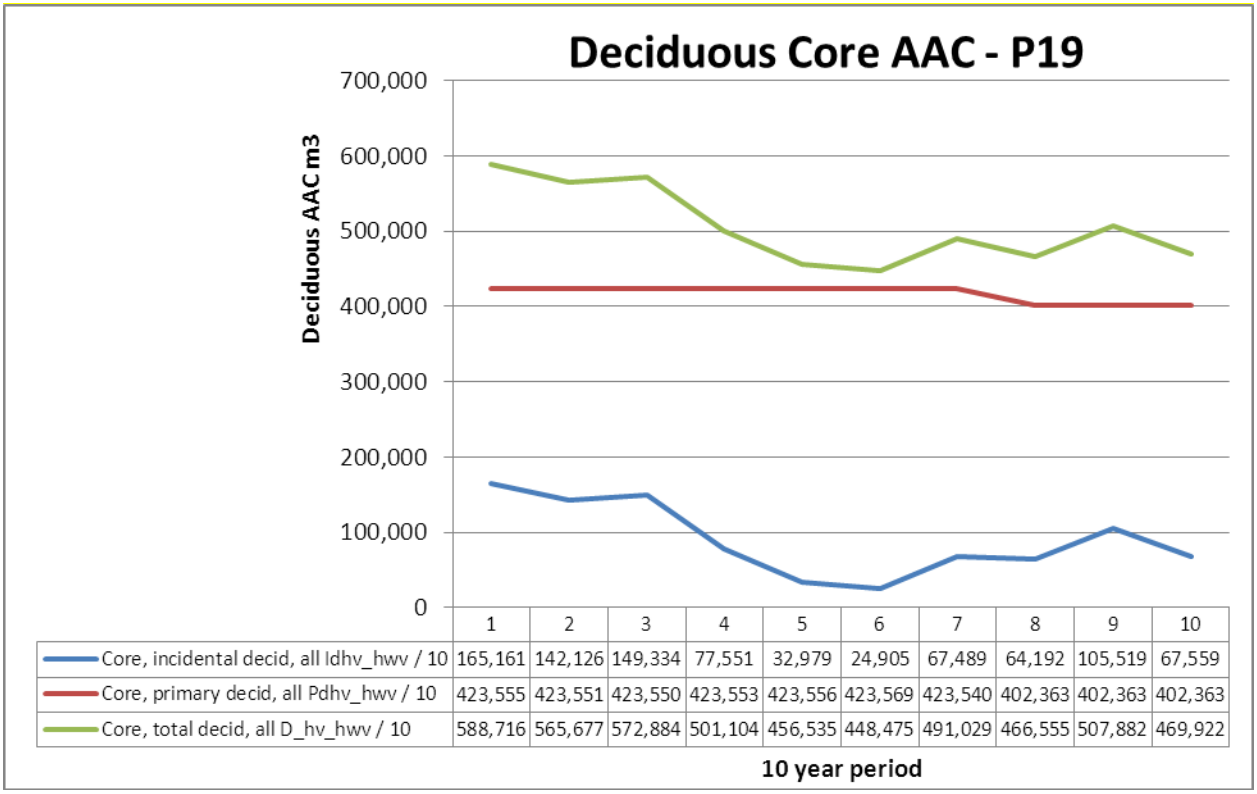
7: Preferred Management Strategy

The forecasted sustainable harvest levels are outlined in Table 9. These values do not incorporate any structure retention or planning losses. The AAC numbers are presented here for approval of the calculation steps.

Table 9. Forecast Annual Allowable Cuts from Spatial Playback (Nov 24, 2011 Final Run)

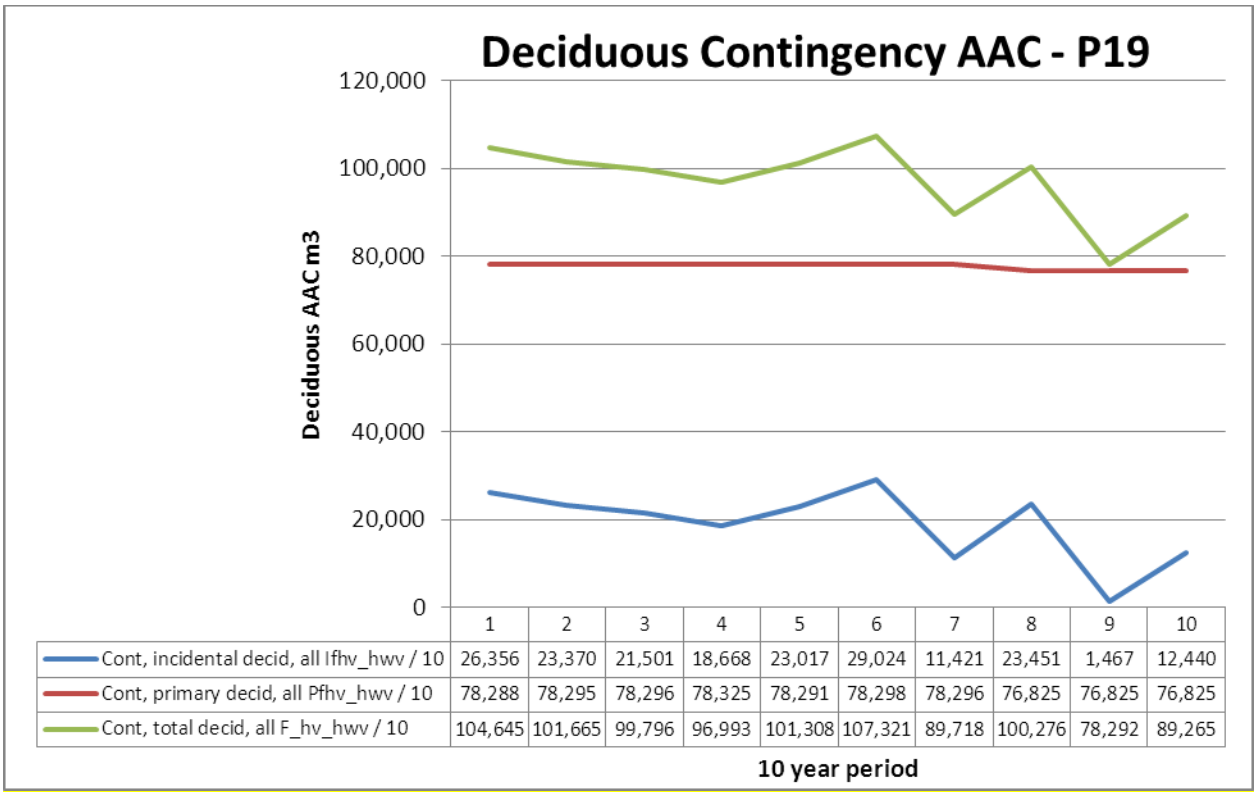
Draft PFMS, spatial playback (05_pfms_spb)	November-24-11																				200 year Average	Period 2 - 20 190 year average	Period 2 - 7 60 year average
NAME	PERIOD1	PERIOD2	PERIOD3	PERIOD4	PERIOD5	PERIOD6	PERIOD7	PERIOD8	PERIOD9	PERIOD10	PERIOD11	PERIOD12	PERIOD13	PERIOD14	PERIOD15	PERIOD16	PERIOD17	PERIOD18	PERIOD19	PERIOD20			
Cont, incidental decid, all	26,356	23,370	21,501	18,668	23,017	29,024	11,421	23,451	1,467	12,440	19,207	21,572	27,619	13,657	18,190	33,148	14,409	21,791	11,643	31,859	20,190	19,866	21,167
Cont, primary decid, all	78,288	78,295	78,296	78,325	78,291	78,298	78,296	76,825	76,825	76,825	80,869	80,869	80,869	76,825	76,825	76,825	80,869	80,869	80,869	80,869	78,756	78,781	78,300
Cont, total decid, all	104,645	101,665	99,796	96,993	101,308	107,321	89,718	100,276	78,292	89,265	100,075	102,441	108,487	90,482	95,015	109,973	95,278	102,660	92,511	112,727	98,946	98,646	99,467
Core, incidental decid, all	165,161	142,126	149,334	77,551	32,979	24,905	67,489	64,192	105,519	67,559	142,109	192,523	334,448	105,366	38,635	53,217	68,380	98,661	132,967	361,719	121,242	118,930	82,397
Core, primary decid, all	423,555	423,551	423,550	423,553	423,556	423,569	423,540	402,363	402,363	402,363	402,363	423,540	423,540	402,363	402,363	402,363	422,884	423,540	423,540	423,540	416,100	415,708	423,553
Core, total decid, all	588,716	565,677	572,884	501,104	456,535	448,475	491,029	466,555	507,882	469,922	544,472	616,063	757,988	507,729	440,999	455,580	491,264	522,201	556,507	785,259	537,342	534,638	505,951
Cont, incidental conifer, north	573	3,771	11,709	27,454	19,951	31,648	6,445	10,010	471	11,129	4,562	6,552	5,011	9,988	10,232	13,594	4,332	3,388	2,439	4,706	9,398	9,863	16,829
Cont, primary conifer, north	22,662	22,964	23,304	25,174	25,181	25,175	24,724	26,026	26,026	26,026	26,026	26,026	24,724	24,724	24,724	24,724	24,724	24,724	26,026	26,026	24,985	25,108	24,420
Cont, total conif, north	23,234	26,734	35,013	52,628	45,132	56,822	31,169	36,036	26,496	37,155	30,588	32,578	29,736	34,712	34,956	38,318	29,056	28,112	28,464	30,732	34,384	34,970	41,250
Core, incidental conif, north	36,408	58,249	60,266	74,348	57,484	34,265	26,092	37,138	21,684	22,274	37,245	24,769	27,075	26,855	23,857	25,698	23,629	33,004	20,286	24,319	34,747	34,660	51,784
Core, primary conifer, north	57,816	57,835	57,798	57,807	57,810	57,814	57,759	57,759	57,759	57,759	57,759	57,759	54,871	54,871	54,871	54,871	54,871	54,871	54,871	57,759	56,764	56,709	57,804
Core, total conif, north	94,223	116,084	118,065	132,155	115,294	92,079	83,850	94,896	79,443	80,033	95,004	82,528	81,946	81,725	78,728	80,568	78,500	87,875	75,156	82,078	91,511	91,369	109,588
Cont, incidental conifer, south	18,592	43,384	47,035	40,349	22,483	18,398	20,892	20,846	2,531	14,782	20,778	18,082	13,755	16,125	16,542	5,468	10,239	8,738	5,582	21,145	19,287	19,324	32,090
Cont, primary conifer, south	123,951	133,284	124,546	126,873	130,302	132,046	138,878	146,188	146,188	146,188	146,188	146,188	138,878	138,878	138,878	138,878	138,878	138,878	146,188	146,188	138,323	139,080	130,988
Cont, total conif, south	142,542	176,669	171,580	167,222	152,785	150,444	159,771	167,034	148,719	160,970	166,966	164,270	152,634	155,003	155,421	144,346	149,118	147,616	151,770	167,333	157,611	158,404	163,078
Core, incidental conif, south	116,849	197,097	155,672	99,170	146,255	139,732	112,770	181,333	68,544	54,896	127,220	80,466	89,250	40,809	41,587	73,298	102,617	85,055	57,087	93,646	103,168	102,448	141,783
Core, primary conifer, south	374,987	192,853	192,854	192,816	192,871	192,829	192,853	197,009	197,009	197,009	197,009	197,009	187,158	187,158	187,158	187,158	187,158	187,158	197,009	197,009	201,704	192,583	192,846
Core, total conifer, south	491,835	389,949	348,525	291,986	339,126	332,561	305,623	378,342	265,553	251,905	324,229	277,475	276,408	227,967	228,745	260,456	289,775	272,213	254,096	290,654	304,871	295,031	334,628
VSA1 Conifer Total	117,457	142,818	153,077	184,783	160,426	148,901	115,019	130,932	105,939	117,188	125,592	115,106	111,681	116,437	113,684	118,886	107,556	115,987	103,620	112,810	125,895	126,339	150,837
VSA2 Conifer Total	634,378	566,618	520,106	459,208	491,911	483,005	465,393	545,376	414,272	412,875	491,195	441,744	429,042	382,971	384,165	404,802	438,892	419,829	405,866	457,987	462,482	453,435	497,707
P19 Conifer Total	751,835	709,436	673,183	643,990	652,336	631,906	580,412	676,308	520,211	530,063	616,786	556,850	540,723	499,408	497,849	523,689	546,448	535,816	509,486	570,797	588,377	579,774	648,544
Total hardwood harvest	693,360	667,342	672,680	598,096	557,843	555,796	580,747	566,831	586,173	559,187	644,547	718,504	866,476	598,212	536,013	565,553	586,542	624,861	649,018	897,986	636,288	633,285	605,417
Total softwood harvest	751,835	709,436	673,183	643,990	652,336	631,906	580,412	676,308	520,211	530,063	616,786	556,850	540,723	499,408	497,849	523,689	546,448	535,816	509,486	570,797	588,377	579,774	648,544
Total harvest volume	1,445,195	1,376,778	1,345,863	1,242,087	1,210,179	1,187,702	1,161,159	1,243,138	1,106,384	1,089,250	1,261,333	1,275,354	1,407,198	1,097,619	1,033,863	1,089,241	1,132,990	1,160,677	1,158,504	1,468,783	1,224,665	1,213,058	1,253,961
Total Primary Hardwood Harvest	501,843	501,847	501,846	501,878	501,847	501,867	501,836	479,188	479,188	479,188	483,232	504,409	504,409	479,188	479,188	479,188	503,753	504,409	504,409	504,409	494,856	494,488	501,853
Total Primary Softwood Harvest	579,414	406,936	398,501	402,669	406,164	407,864	414,214	426,981	426,981	426,981	426,981	426,981	405,632	405,632	405,632	405,632	405,632	405,632	424,093	426,981	421,776	413,480	406,058
Total Primary Harvest Volume	1,081,257	908,782	900,346	904,547	908,011	909,731	916,050	906,169	906,169	906,169	910,212	931,389	910,040	884,820	884,820	884,820	909,384	910,040	928,501	931,389	916,632	907,968	907,911
Total Secondary Hardwood Harvest	191,517	165,496	170,834	96,219	55,996	53,929	78,910	87,643	106,985	79,999	161,316	214,095	362,067	119,023	56,825	86,365	82,790	120,452	144,610	393,578	141,432	138,796	103,564
Total Secondary Softwood Harvest	172,420	302,500	274,682	241,321	246,173	224,042	166,199	249,327	93,230	103,082	189,805	129,870	135,091	93,776	92,218	118,057	140,816	130,185	85,394	143,817	166,600	166,294	242,486
Total Secondary Harvest Volume	363,938	467,996	445,516	337,540	302,169	277,971	245,109	336,970	200,215	183,081	351,121	343,965	497,158	212,800	149,043	204,422	223,606	250,637	230,003	537,394	308,033	305,090	346,050
Primary D volume, core D stand, core C cost zone	419,769	369,513	332,231	336,653	372,128	378,973	372,829	379,664	400,054	346,176	344,228	330,905	369,968	331,301	328,094	361,885	404,619	366,656	378,404	332,934	362,849	359,853	360,388
Primary C volume, core C (north) stand, core D cost zone	52,978	56,568	52,610	55,260	34,906	20,880	47,874	43,131	55,914	52,162	26,340	50,966	49,707	54,378	35,603	20,196	37,746	44,550	51,252	53,331	44,818	44,388	44,683
Primary C volume, core C (south) stand, core D cost zone	374,987	188,916	192,854	192,816	192,871	192,829	192,853	197,009	197,009	197,009	197,009	197,009	187,158	187,158	187,158	187,158	187,158	187,158	197,009	197,009	201,507	192,376	192,190
Primary D volume, cont D stands, core C cost zone	26,153	31,448	44,538	27,666	37,441	16,384	35,611	20,907	38,927	39,147	39,146	44,590	64,744	19,732	26,689	46,749	50,665	59,159	43,651	66,965	39,016	39,693	32,181
Primary C volume, core C (north) stand, cont D cost zone	4,837	1,267	5,188	2,547	22,903	36,934	9,885	14,627	1,845	5,597	31,419	6,792	5,164	493	19,268	34,675	17,125	10,321	3,619	4,427	11,947	12,321	13,121
Primary C volume, core C (south) stand, cont D cost zone	0	3,937	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	197	207	656
Incidental C volume, core D stand, core C (north) cost zone	32,535	53,750	53,835	67,330	45,612	28,398	18,390	33,715	18,584	14,026	31,722	22,437	25,427	24,976	19,433	22,951	17,559	29,712	18,028	18,283	29,835	29,693	44,552
Incidental C volume, core D stand, core C (south) cost zone	106,753	194,165	145,944	99,170	145,290	139,604	96,911	173,488	67,848	51,575	110,089	63,828	68,143	39,017	36,638	48,428	88,808	78,150	56,590	37,195	92,382	91,625	136,847
Incidental D volume, Core C stand, core D cost zone	122,625	80,054	108,295	51,871	23,195	17,344	18,895	34,265	71,830	34,165	51,512	84,763	245,519	85,159	26,762	26,086	27,876	61,599	73,812	101,615	67,362	64,453	49,942
Incidental C volume, cont D stand, core C (north) cost zone	3,872	4,499	6,431	7,018	11,872	5,867	7,702	3,423	3,100	8,248	5,523	2,332	1,648	1,879	4,424	2,747	6,070	3,292	2,257	6,037	4,912	4,967	7,232
Incidental C volume, cont D stand, core C (south) cost zone	10,096	2,931	9,728	0	965	128	15,860	7,845	697	3,321	17,131	16,638	21,107	1,792	4,949	24,870	13,809	6,905	498	56,450	10,786	10,822	4,935
Incidental D volume, Core C stand, cont D cost zone	2,147	1,638	2,067	643	6,487	8,286	1,904	3,324	28	806	1,464	3,187	5,956	152	3,491	9,312	4,106	2,680	1,845	2,936	3,123	3,174	3,504
Primary D volume, core D stand, cont C cost zone	3,785	54,038	91,319	86,900	51,428	44,596	50,712	22,700	2,309	56,187	58,135	92,636	53,572	71,062	74,270	40,478	18,265	56,884	45,136	90,607	53,251	55,854	63,165
Primary C volume, cont C (north) stand, core D cost zone	19,832	19,494	14,832	2,780	4,889	8,053	4,045	2,453	4,901	17,080	24,589	20,179	19,466	3,911	4,674	7,959	6,926	4,205	20,243	24,026	11,727	11,300	9,015
Primary C volume, cont C (south) stand, core D cost zone	53,333	83,651	96,460	91,092	72,092	32,513	96,056	117,471	146,065	83,210	108,212	127,649	122,816	92,995	89,997	53,997	105,460	110,190	133,079	133,547	97,494	99,818	78,644
Primary D volume, cont D stands, cont C cost zone	52,135	46,847	33,758	50,659	40,850	61,913	42,685	55,918	37,898	37,678	41,723	36,279	16,124	57,093	50,136	30,077	30,203	21,710	37,217	13,904	39,740	39,088	46,119
Primary C volume, cont C (north) stand, cont D cost zone	2,829	3,469	8,472	22,394	20,292	17,122	20,680	23,573	21,124	8,946	1,437	5,846	5,259	20,814	20,050	16,765	17,799	20,519	5,782	2,000	13,259	13,807	15,405
Primary C volume, cont C (south) stand, cont D cost zone	70,618	49,634	28,085	35,781	58,210	99,533	42,823	28,717	123	62,978	37,976	18,539	16,063	45,884	48,881	84,881	33,419	28,688	13,109	12,641	40,829	39,261	52,344
Incidental C volume, core D stand, cont C (north) cost zone	74	3,038	7,729	13,941	7,910	8,827	373	7,374	37	158	1,909	4,510	3,929	6,703	1,435	6,047	181	2,018	656	3,618	4,023	4,231	6,970
Incidental C volume, core D stand, cont C (south) cost zone	2,007	33,588	45,047	38,721	19,817	12,701	11,548	10,271	549	11,669	15,168	16,311	12,090	11,516	11,444	2,819	8,517	8,738	5,017	11,029	14,428	15,082	26,904
Incidental D volume, Cont C stand, core D cost zone	42,537	62,072	41,038	25,680	9,784	7,562	48,594	29,926	33,689	33,394	90,597	107,760	88,929	20,208	11,874	27,132	40,505	37,062	59,155	260,104	53,880	54,477	32,455
Incidental C volume, cont D stand, cont C (north) cost zone	499	732	3,980	13,513	12,041	22,821	6,071	2,636	434	10,971	2,653	2,042	1,082	3,285	8,797	7,547	4,151	1,370	1,783	1,089	5,375	5,632	9,860
Incidental C volume, cont D stand, cont C (south) cost zone	16,585	9,796	1,988	1,628	2,666	5,697	9,345	10,575	1,983	3,113	5,611	1,771	1,665	4,609	5,099	2,648	1,722	0	566	10,117	4,859	4,242	5,186
Incidental D volume, Cont C stand, cont D cost zone	24,209	21,732	19,434	18,024	16,530	20,737	9,518	20,127	1,439	11,634	17,742	18,385	21,663	13,506	14,698	23,835	10,304	19,112	9,798	28,923	17,067	16,692	17,663

7.1.1 Harvest Volume



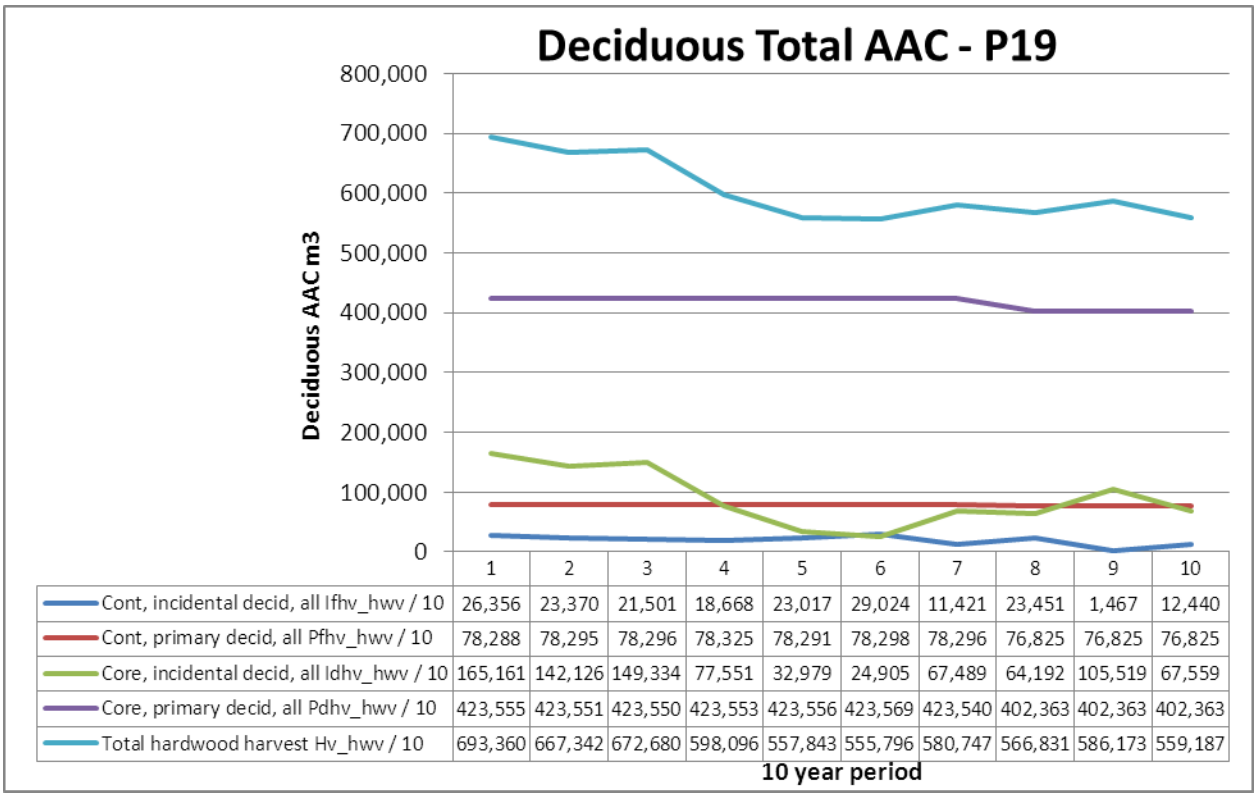
	1	2	3	4	5	6	7	8	9	10
Core, incidental decid, all Idhv_hwv / 10	165,161	142,126	149,334	77,551	32,979	24,905	67,489	64,192	105,519	67,559
Core, primary decid, all Pdhv_hwv / 10	423,555	423,551	423,550	423,553	423,556	423,569	423,540	402,363	402,363	402,363
Core, total decid, all D_hv_hwv / 10	588,716	565,677	572,884	501,104	456,535	448,475	491,029	466,555	507,882	469,922

Figure 7. Deciduous Core AAC for all of FMU P19 combined.



	1	2	3	4	5	6	7	8	9	10
Cont, incidental decid, all Ifhv_hwv / 10	26,356	23,370	21,501	18,668	23,017	29,024	11,421	23,451	1,467	12,440
Cont, primary decid, all Pfhv_hwv / 10	78,288	78,295	78,296	78,325	78,291	78,298	78,296	76,825	76,825	76,825
Cont, total decid, all F_hv_hwv / 10	104,645	101,665	99,796	96,993	101,308	107,321	89,718	100,276	78,292	89,265

Figure 8. Deciduous Contingency AAC for all of FMU P19 combined.



	1	2	3	4	5	6	7	8	9	10
Cont, incidental decid, all Ifhv_hwv / 10	26,356	23,370	21,501	18,668	23,017	29,024	11,421	23,451	1,467	12,440
Cont, primary decid, all Pfhv_hwv / 10	78,288	78,295	78,296	78,325	78,291	78,298	78,296	76,825	76,825	76,825
Core, incidental decid, all Idhv_hwv / 10	165,161	142,126	149,334	77,551	32,979	24,905	67,489	64,192	105,519	67,559
Core, primary decid, all Pdhv_hwv / 10	423,555	423,551	423,550	423,553	423,556	423,569	423,540	402,363	402,363	402,363
Total hardwood harvest Hv_hwv / 10	693,360	667,342	672,680	598,096	557,843	555,796	580,747	566,831	586,173	559,187

Figure 9. Total Deciduous AAC from all sources for FMU P19.

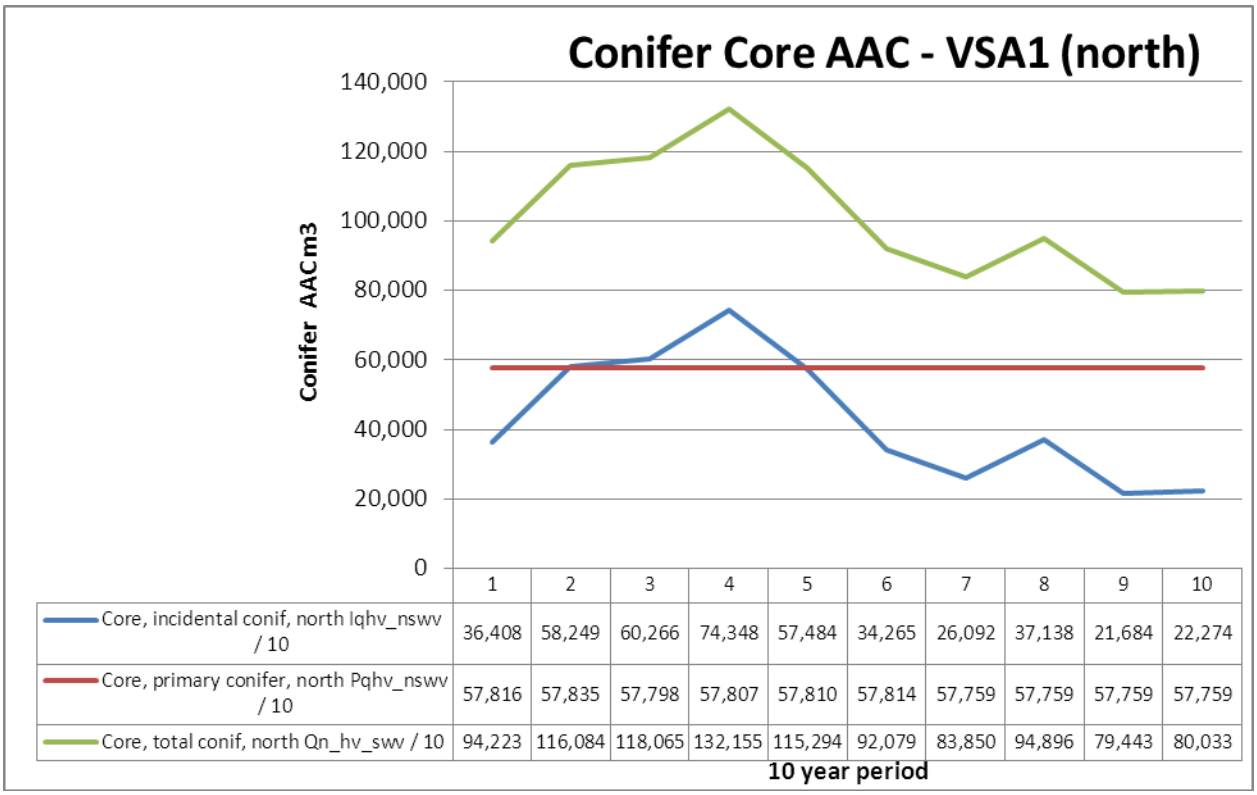
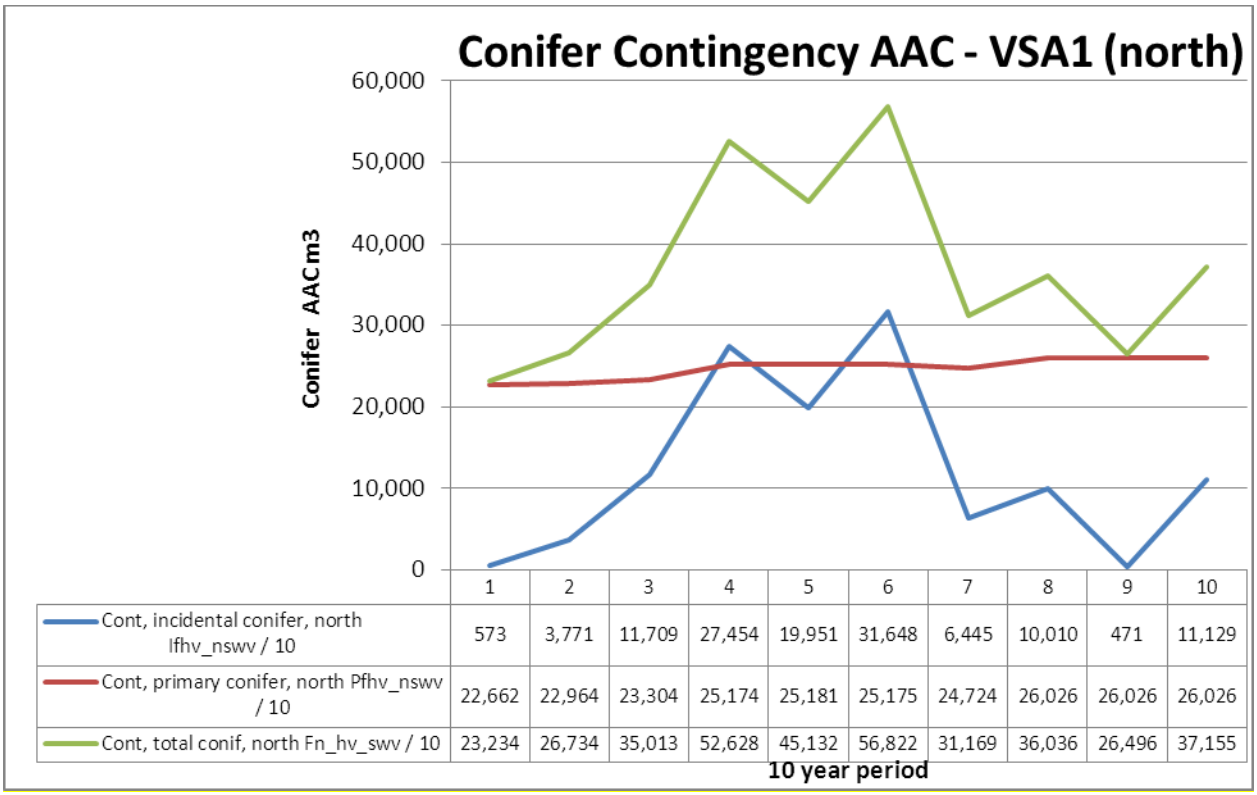
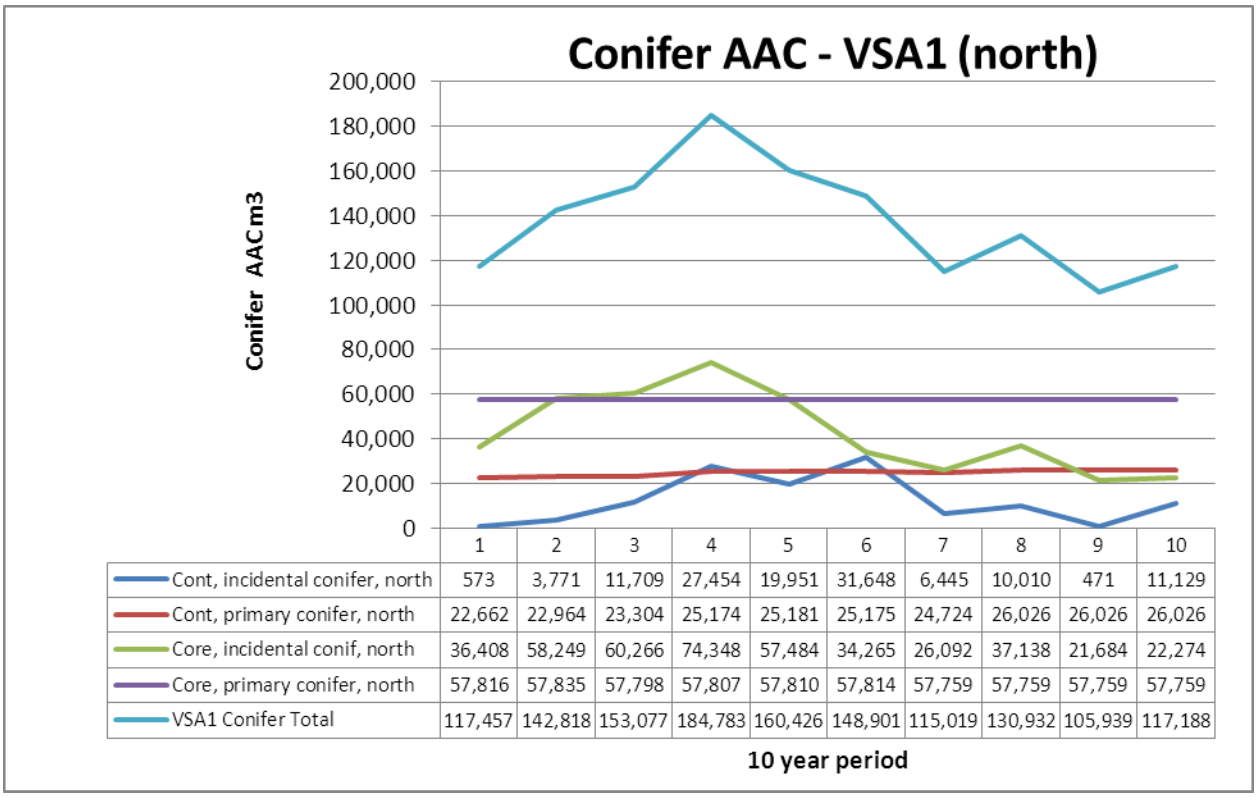


Figure 10. Conifer Core AAC for VSA1 (north).



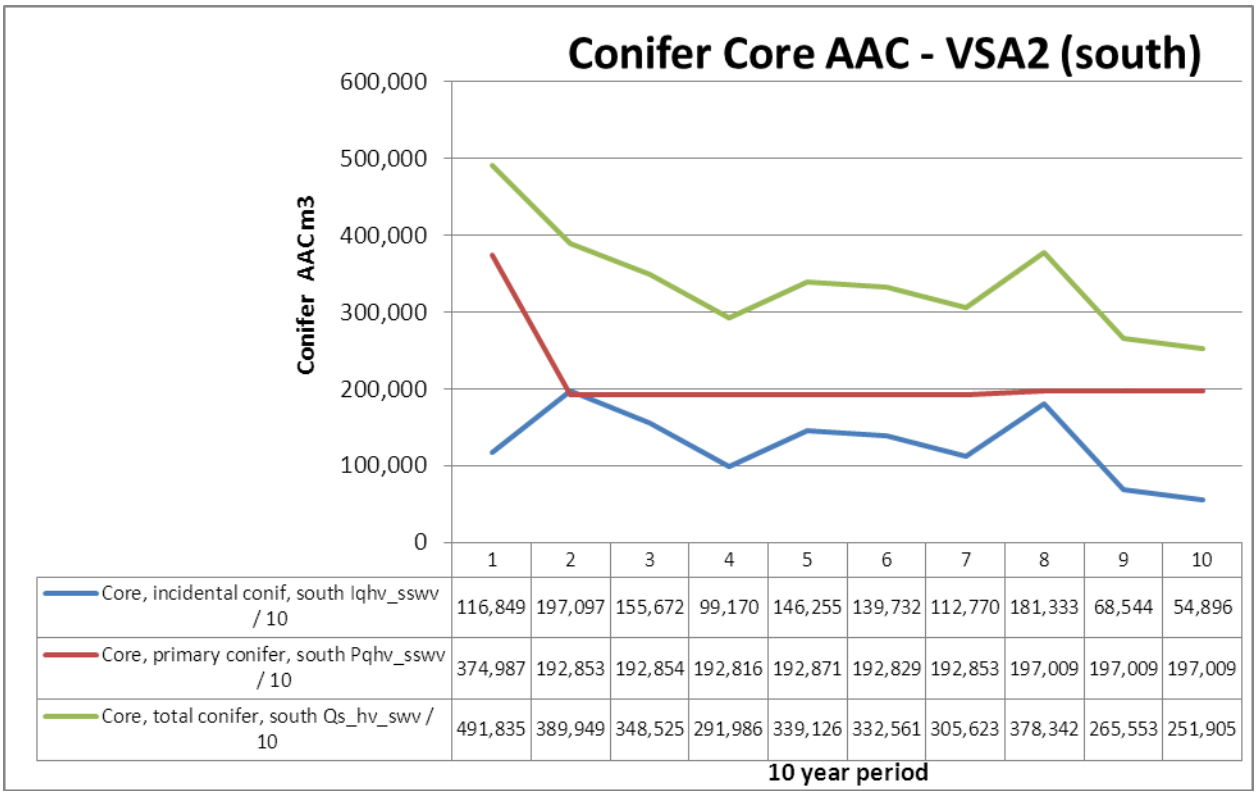
	1	2	3	4	5	6	7	8	9	10
Cont, incidental conifer, north lfhv_nswv / 10	573	3,771	11,709	27,454	19,951	31,648	6,445	10,010	471	11,129
Cont, primary conifer, north Pfhv_nswv / 10	22,662	22,964	23,304	25,174	25,181	25,175	24,724	26,026	26,026	26,026
Cont, total conif, north Fn_hv_swv / 10	23,234	26,734	35,013	52,628	45,132	56,822	31,169	36,036	26,496	37,155

Figure 11. Conifer Contingency AAC for VSA1 (north).



	1	2	3	4	5	6	7	8	9	10
Cont, incidental conifer, north	573	3,771	11,709	27,454	19,951	31,648	6,445	10,010	471	11,129
Cont, primary conifer, north	22,662	22,964	23,304	25,174	25,181	25,175	24,724	26,026	26,026	26,026
Core, incidental conif, north	36,408	58,249	60,266	74,348	57,484	34,265	26,092	37,138	21,684	22,274
Core, primary conifer, north	57,816	57,835	57,798	57,807	57,810	57,814	57,759	57,759	57,759	57,759
VSA1 Conifer Total	117,457	142,818	153,077	184,783	160,426	148,901	115,019	130,932	105,939	117,188

Figure 12. Total Conifer AAC from all sources in VSA1 (north).



	1	2	3	4	5	6	7	8	9	10
Core, incidental conif, south Iqhv_sswv / 10	116,849	197,097	155,672	99,170	146,255	139,732	112,770	181,333	68,544	54,896
Core, primary conifer, south Pqhv_sswv / 10	374,987	192,853	192,854	192,816	192,871	192,829	192,853	197,009	197,009	197,009
Core, total conifer, south Qs_hv_swv / 10	491,835	389,949	348,525	291,986	339,126	332,561	305,623	378,342	265,553	251,905

Figure 13. Conifer Core AAC for VSA2 (south).

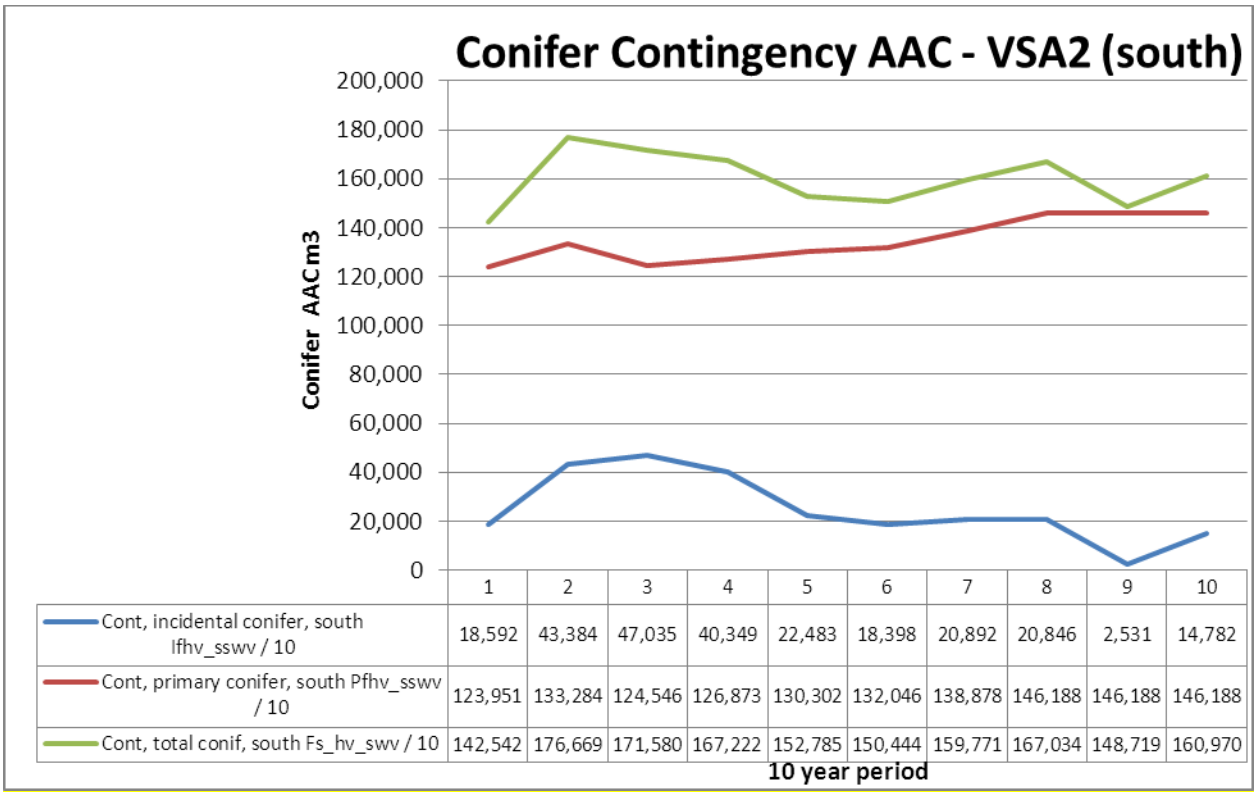


Figure 14. Conifer Contingency AAC for VSA2 (south).

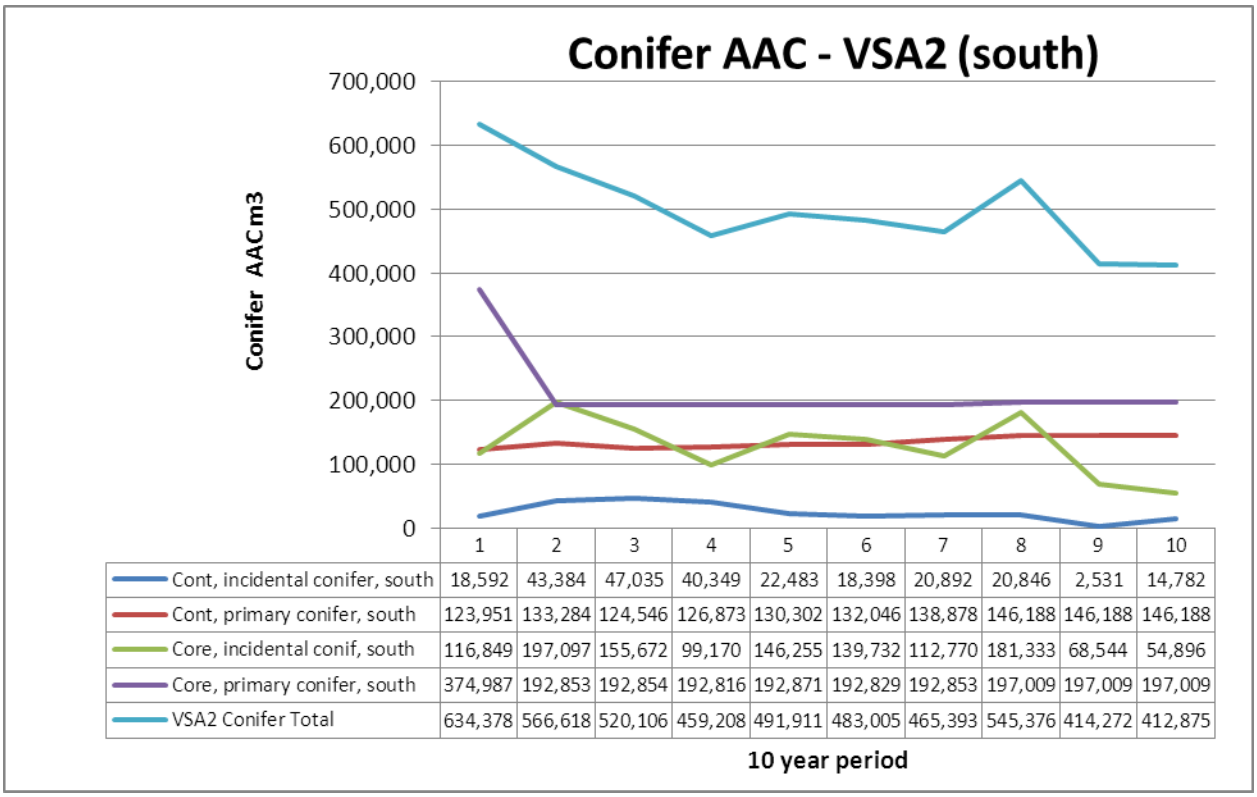
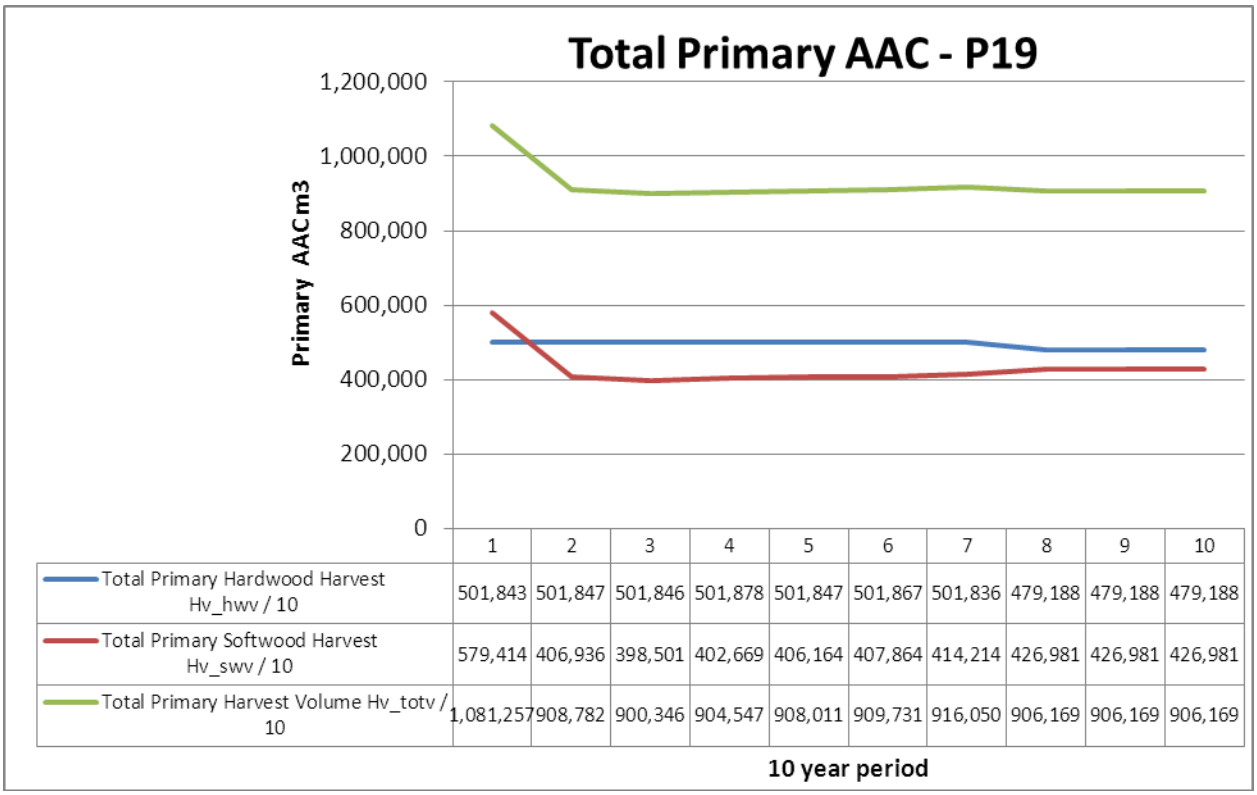
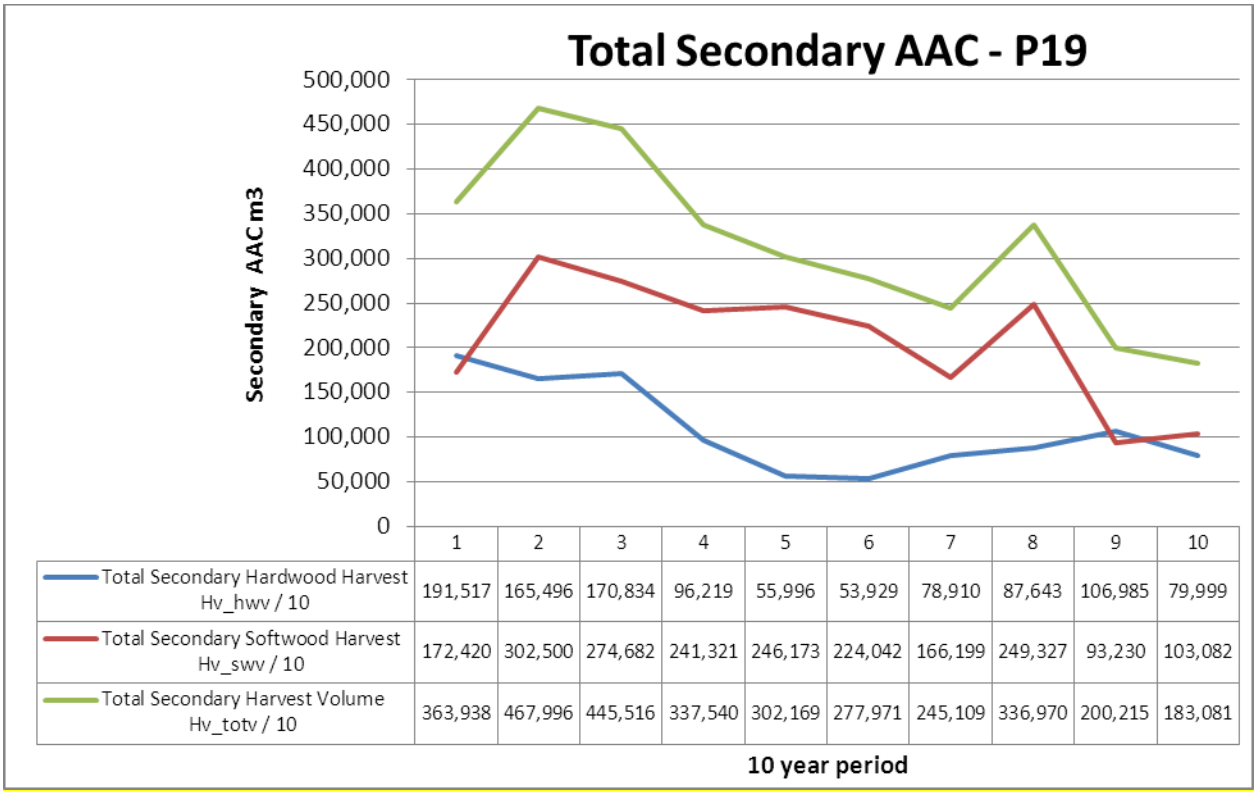


Figure 15. Total Conifer AAC from all sources in VSA2(south).



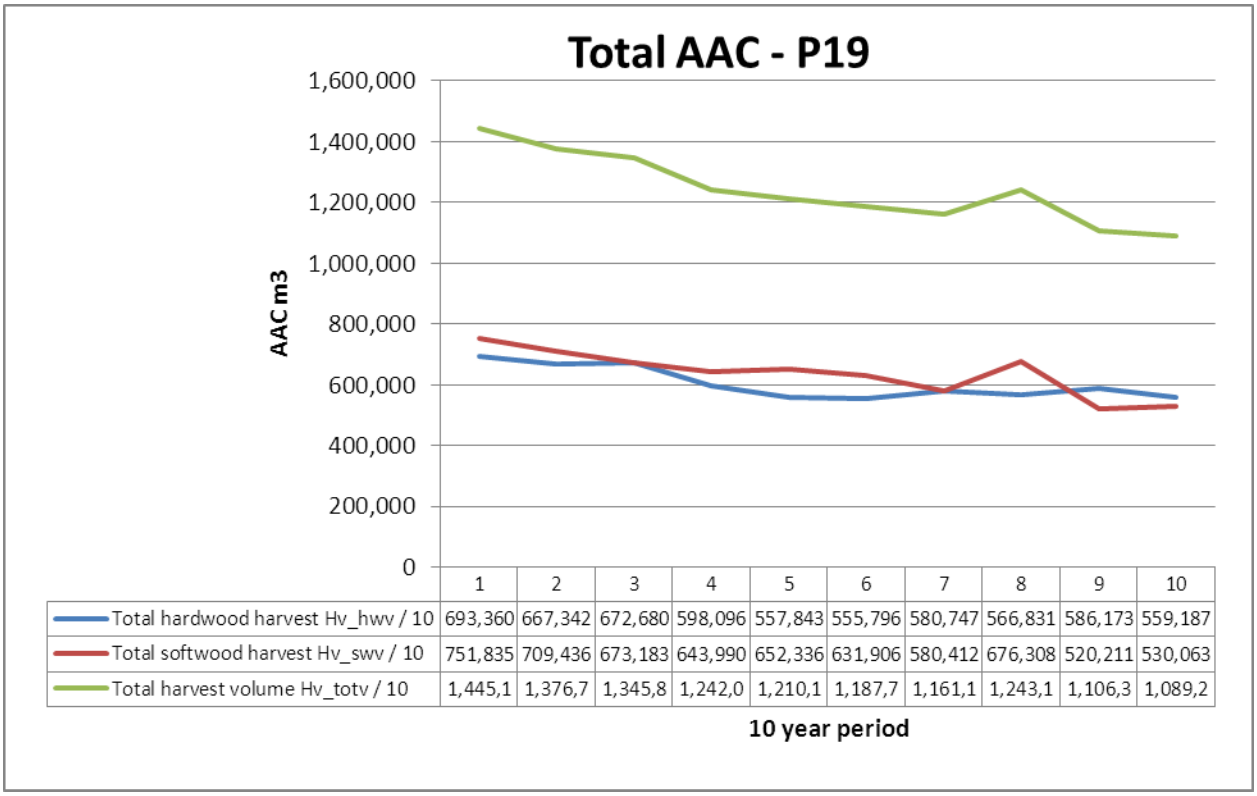
	1	2	3	4	5	6	7	8	9	10
Total Primary Hardwood Harvest Hv_hwv / 10	501,843	501,847	501,846	501,878	501,847	501,867	501,836	479,188	479,188	479,188
Total Primary Softwood Harvest Hv_swv / 10	579,414	406,936	398,501	402,669	406,164	407,864	414,214	426,981	426,981	426,981
Total Primary Harvest Volume Hv_totv / 10	1,081,257	908,782	900,346	904,547	908,011	909,731	916,050	906,169	906,169	906,169

Figure 16. Total Primary AAC for FMU P19.



	1	2	3	4	5	6	7	8	9	10
Total Secondary Hardwood Harvest Hv_hwv / 10	191,517	165,496	170,834	96,219	55,996	53,929	78,910	87,643	106,985	79,999
Total Secondary Softwood Harvest Hv_swv / 10	172,420	302,500	274,682	241,321	246,173	224,042	166,199	249,327	93,230	103,082
Total Secondary Harvest Volume Hv_totv / 10	363,938	467,996	445,516	337,540	302,169	277,971	245,109	336,970	200,215	183,081

Figure 17. Total Secondary AAC for FMU P19.



	1	2	3	4	5	6	7	8	9	10
Total hardwood harvest Hv_hwv / 10	693,360	667,342	672,680	598,096	557,843	555,796	580,747	566,831	586,173	559,187
Total softwood harvest Hv_swv / 10	751,835	709,436	673,183	643,990	652,336	631,906	580,412	676,308	520,211	530,063
Total harvest volume Hv_totv / 10	1,445,1	1,376,7	1,345,8	1,242,0	1,210,1	1,187,7	1,161,1	1,243,1	1,106,3	1,089,2

Figure 18. Total AAC for FMU P19.

8: Spatial Harvest Sequence

This section describes the selected harvest sequence. It is derived from the Stanley spatial playback of Nov 24, 2011.

8.1 PreBlock Selection

DMI, Canfor, and Zavisha selected at least ten years of harvest blocks for placement in the TSA model. All known harvest blocks and planned blocks to be operated after 2009 (start date of the TSA model) were identified. The 2007 approved spatial harvest sequence was used as a start point and field checks were performed. The companies made stand selections based on access, season of operation, and merchantability criteria. Attempts were made to aggregate blocks and generally select block collections that could be economically operated.

Canfor and Zavisha selected blocks in regions that they predetermined based on historical license areas. They strongly biased their selections to capture pine content.

The first attempts at blocking were run through the model to check sustainability. Some white spruce mixedwood blocks were moved to the second period. Another pass was made to capture stands that might be isolated and to better integrate deciduous and coniferous preblocks. At this stage, the PDT determined that a surge for pine capture would be acceptable and some more endangered pine was added.

At the end of the iterative process, a 1 period conifer surge was selected in VSA2 (south).

Tolko did not preblock in VSA1 (north). DMI selected deciduous blocks based on ground surveillance of the 2007 schedule and making adjustments to better integrate with the conifer preschedule. Location of non-frozen ground blocks was a major consideration in the DMI selections. The sustainability checks forced some blocks to be moved to the 2nd period.

8.2 Block Assignment to Company

Following allocation of the AAC percentages (see description below) the first period blocks were assigned to companies. The companies worked co-operatively to divide the pool of blocks. In the end, little change was required from the manual selections that identified the stands.

Tolko labeled all conifer blocks in VSA1(north).

DMI labeled all deciduous blocks in both VSA1 and VSA2.

Zavisha selected a centralized area of VSA2(south) to concentrate its harvests based on their traditional active license area. They selected blocks up to their allotted AAC (including the DMI AAC to be used by Zavisha). Canfor labeled the rest of the conifer blocks in VSA2. The 10 year sum of AACs by company were balanced in the block selections to within 200m3.

8.2.1 Cautionary Note

The block assignment to companies was completed with the Volume Supply Area concept leading decisions. The individual companies want the VSAs to protect their traditional harvest areas. As examples:

- Tolko traditionally was the only conifer operator in VSA1 (old P10). They wish to continue to be the only conifer operator (with the exception of the DMI primary volume) and they do not want to have to go to VSA2 to fulfill their AAC.
- Canfor and Zavisha want to fulfill their AAC in VSA2 and do not want to see Tolko in VSA2.

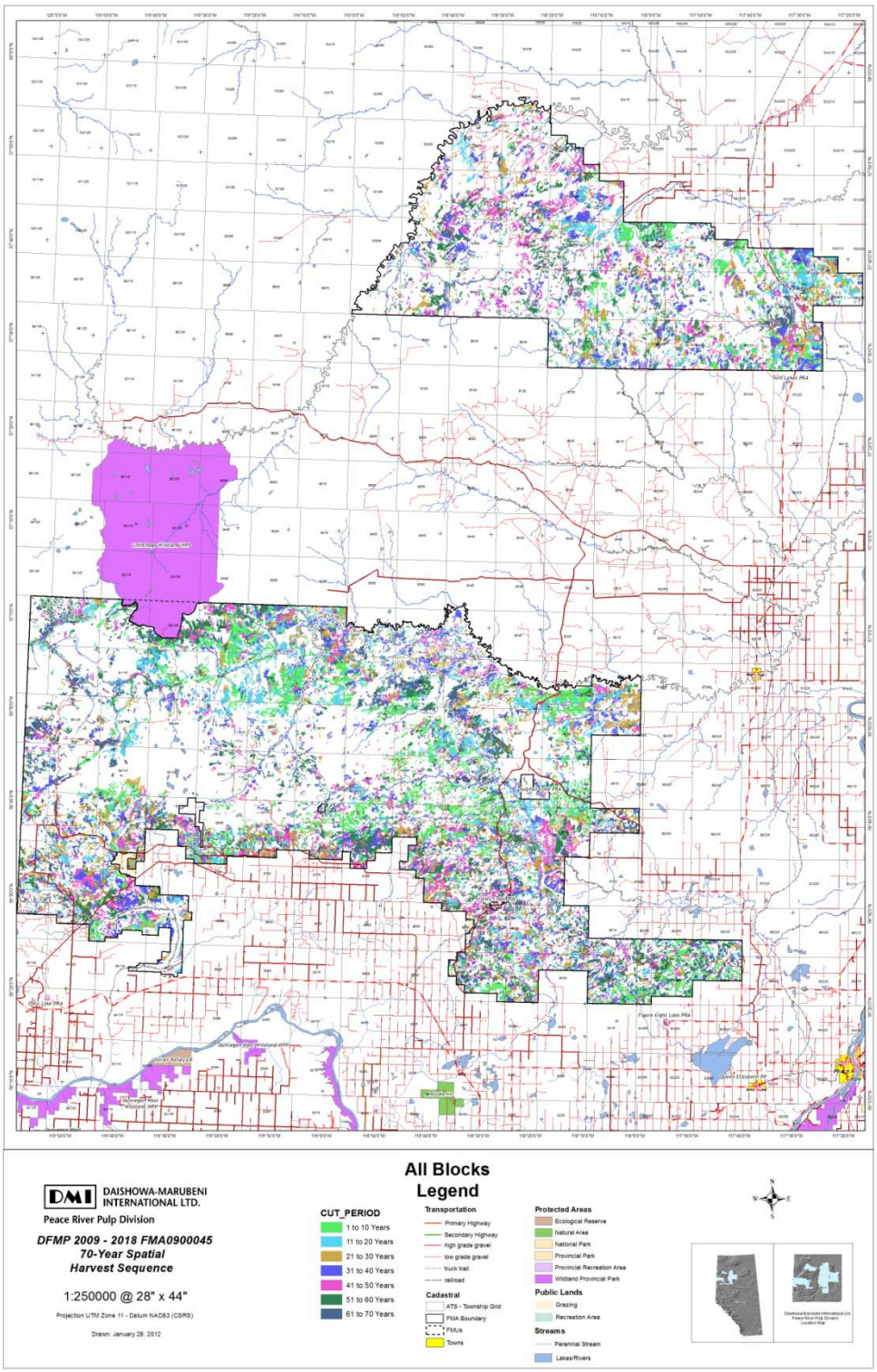
The block assignments respected the VSA boundaries. Target block volumes by company were based on the existing percentage splits within a VSA applied to the new sequence (see Figure 19 for splits). For example, the Canfor block assignment targeted 74% of the new sequence 1st period conifer primary harvest level within VSA2. (as opposed to targeting 56.67% of the total P19 harvest level).

The new splits are a government administrative requirement and will ultimately control long term harvest levels by company. Therefore, it is recognized that the spatial allocation to companies will not exactly match the theoretical calculation of splits. (the splits are based on 200 year average AAC and the spatial is one 10 year period of actual blocks.)

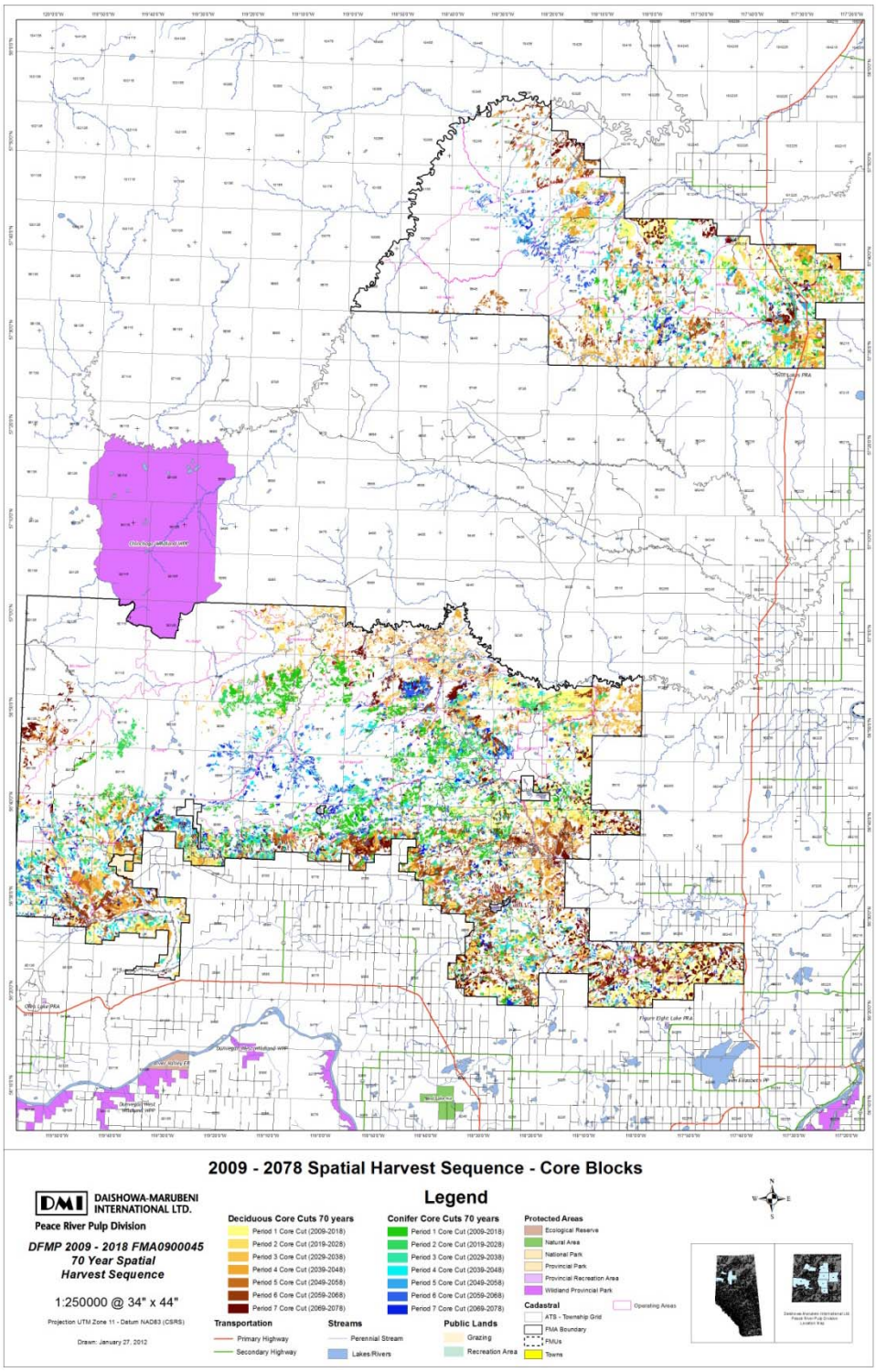
It is understood by all parties that the block assignments are an approximation. AACs are, in fact, governed by volume control. Forest level AVI inventories and age-dependent yield estimates will inevitably, at times, be inaccurate at the block level. Ultimately, each company must carefully track periodic cuts. This is particularly important where secondary volumes are used and planned for. **If AAC's are fully utilized, it is a certainty that some block allocation changes will have to be made during the life of this plan.**

In cases where the block allocation and the company AACs are inconsistent, the companies will agree on switching blocks. The central theme of protecting core primary AAC within VSAs will prevail. Contingency will be used wherever possible to reconcile AACs and allocated blocks within a VSA.

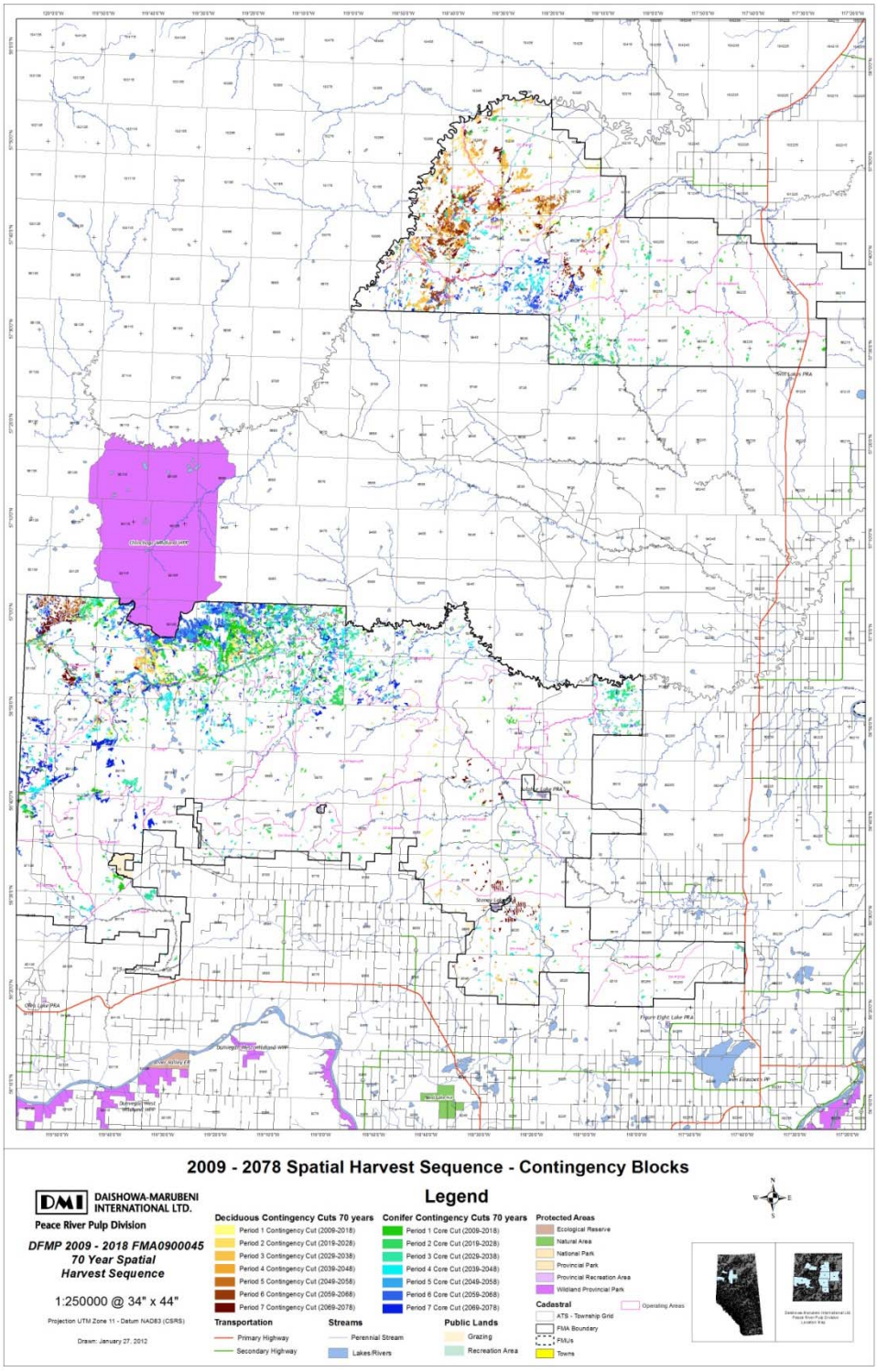
8.3 70 Year Harvest Sequence by Period- Total Footprint



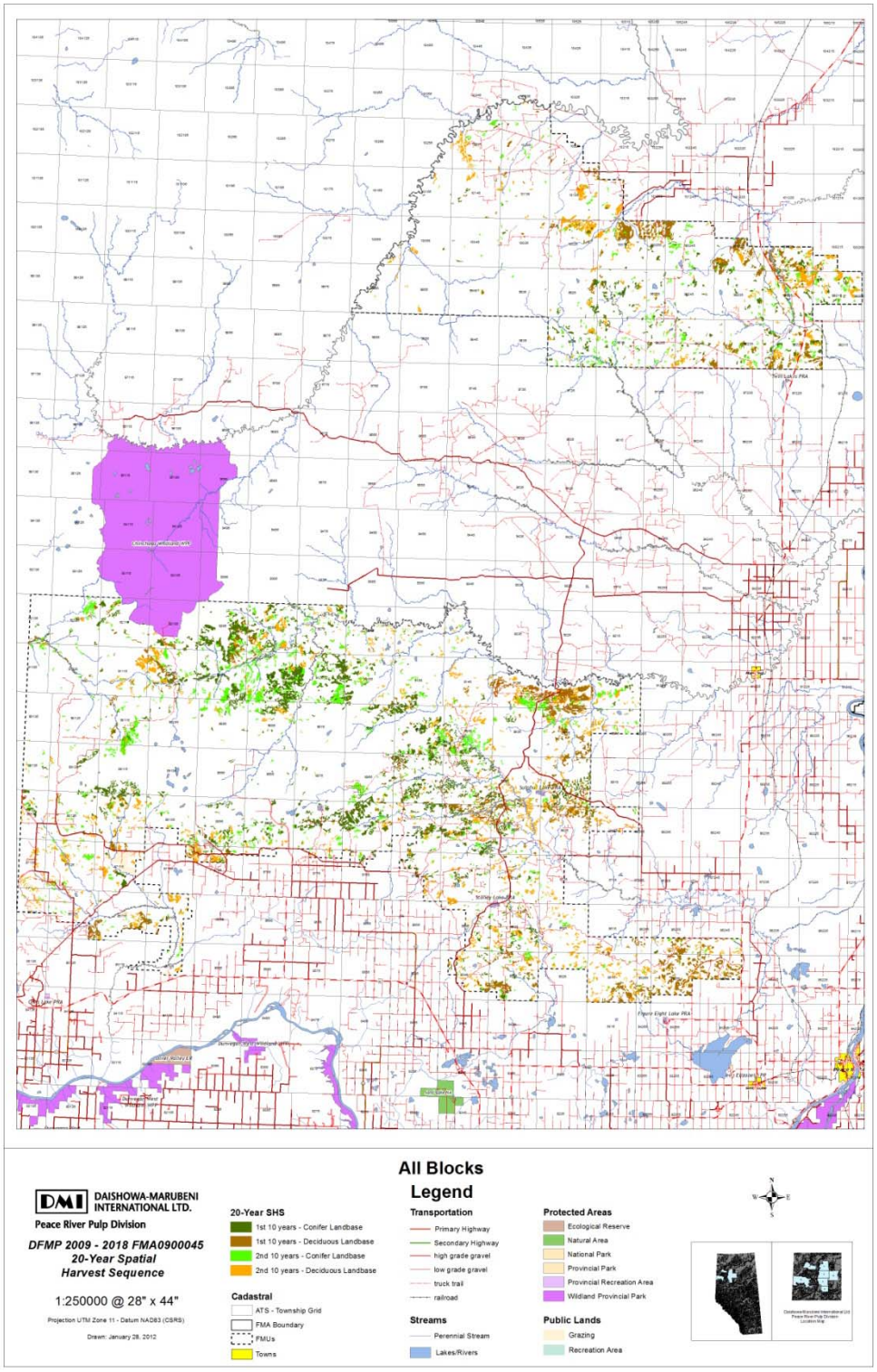
8.4 70 Year Core Sequence by Conifer/Deciduous/Period



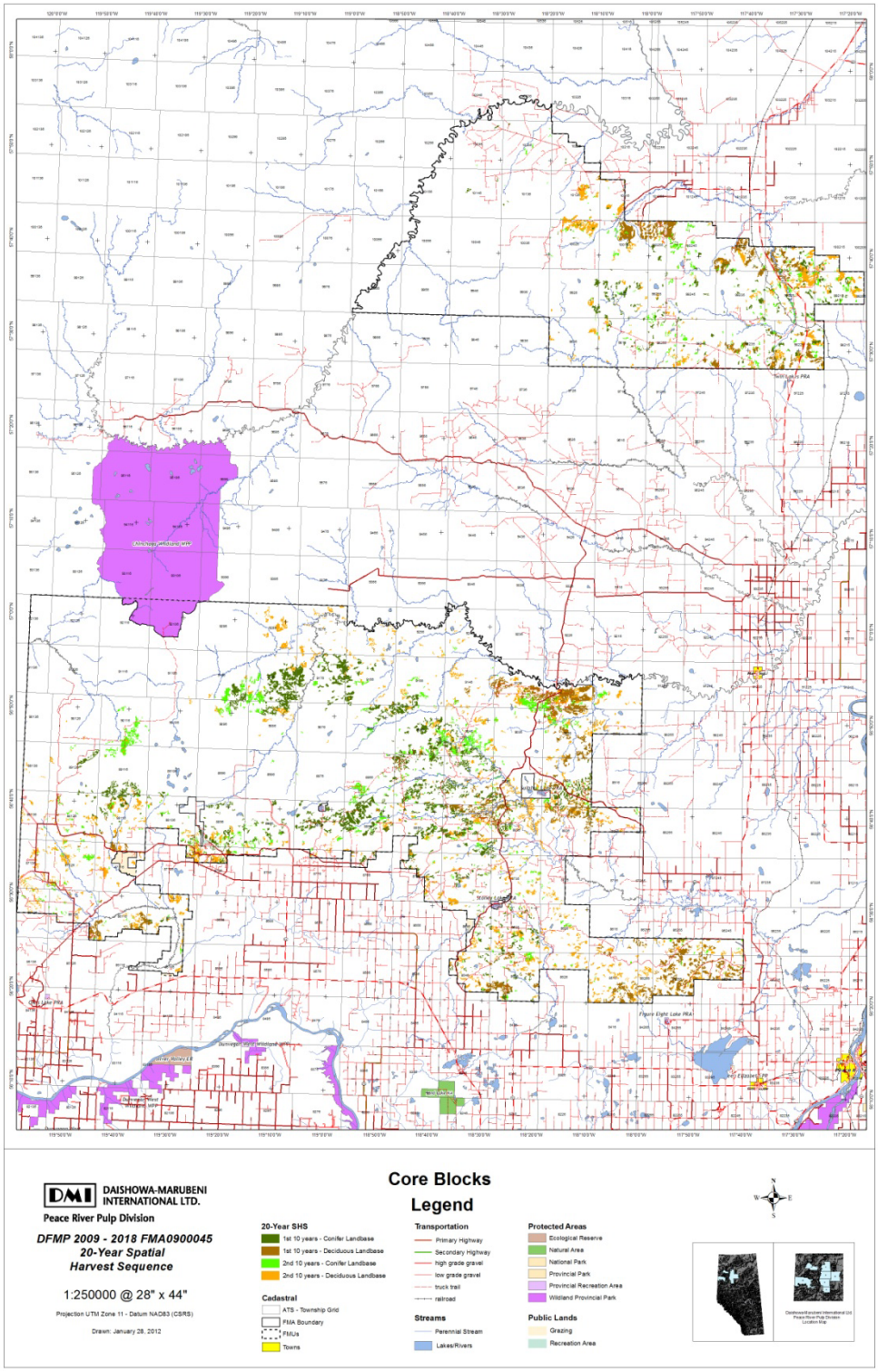
8.5 70 Year Contingency Sequence by Conifer/Deciduous/Period



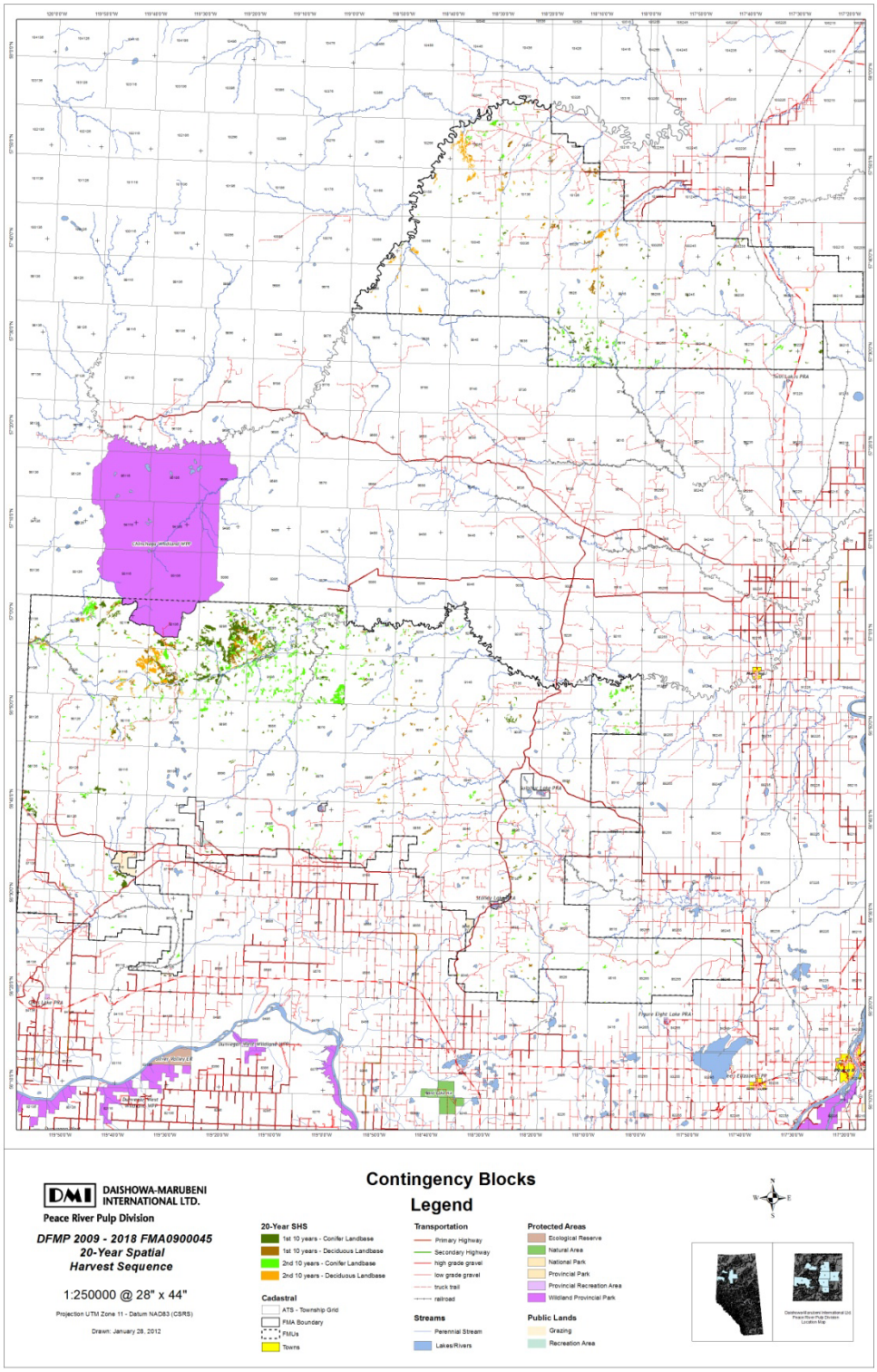
8.6 20 Year Spatial Sequence by Conifer/Deciduous/Period



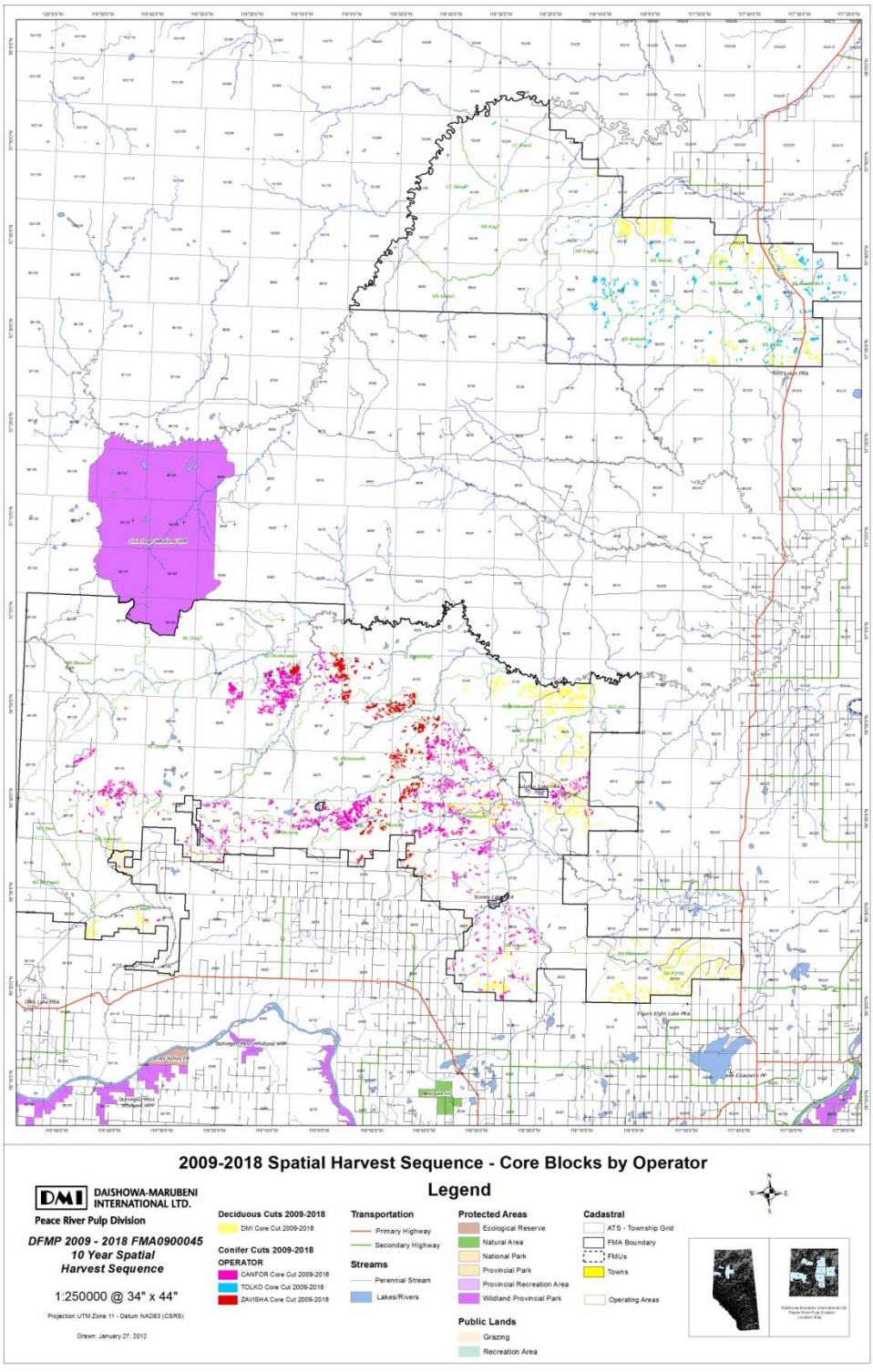
8.7 20 Year Core Sequence by Conifer/Deciduous/Period



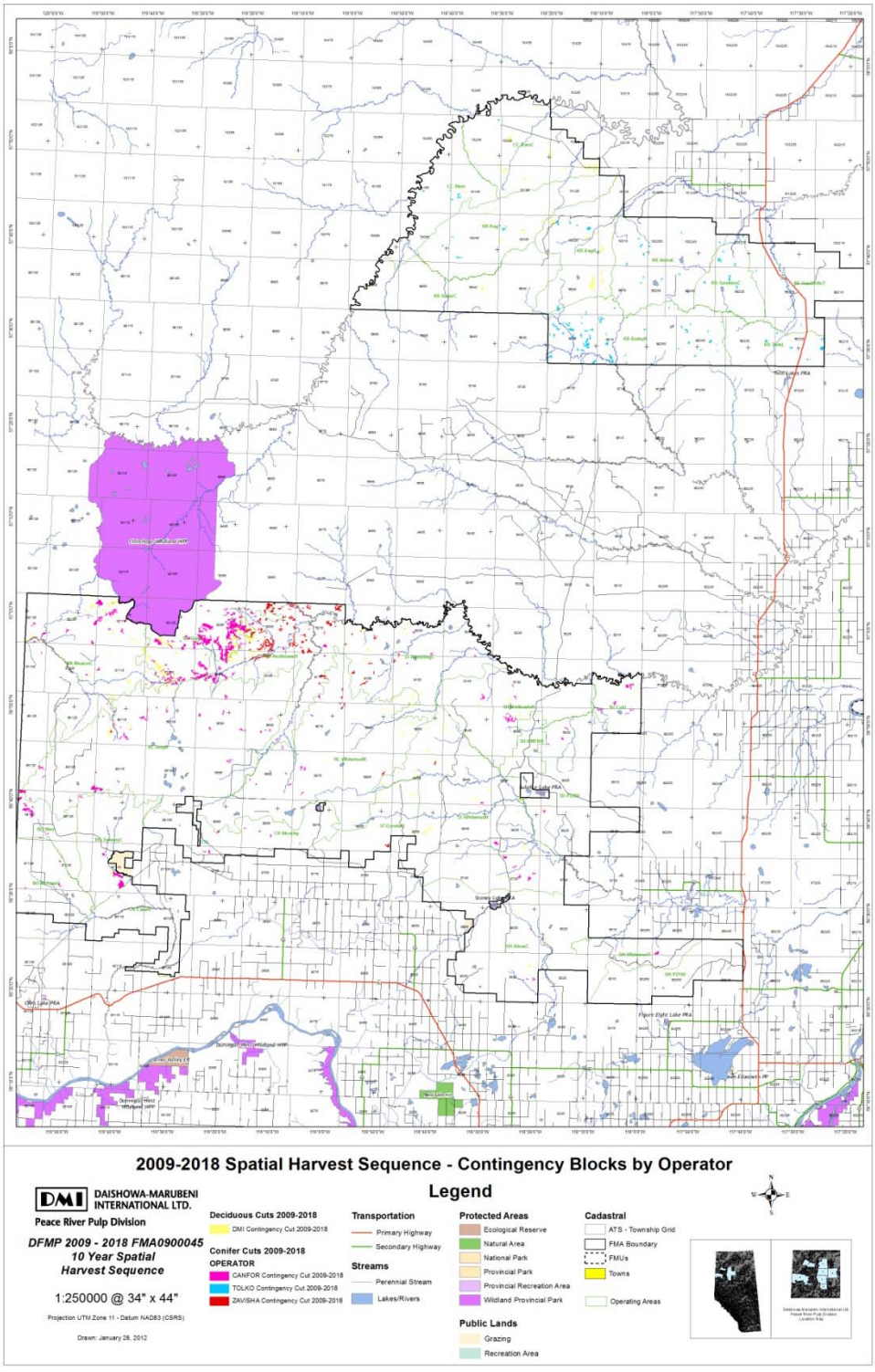
8.8 20 Year Contingency Sequence by Conifer/Deciduous/Period



8.9 10 Year Core Spatial Harvest Sequence by Company



8.10 10 Year Contingency Spatial Harvest Sequence by Company



8.11 Forest Profile vs Harvest Profile

The following section describes the general makeup of the first 10 year spatial sequence as compared to the available pool of stands.

Table 10. Area volume summary of period 1 spatial harvest sequence by company/VSA/Core-Contingency.

VSA	OPERATOR	Core / Contingency Supply	Sum of Treed Area (ha)	Sum of SW Volume (m3)	Sum of HW Volume (m3)
VSA1	DMI	CONT_D	1,128	43,701	229,374
VSA1	DMI	CORE_D	5,868	326,017	1,328,080
VSA1	TOLKO	CONT_C	1,505	226,611	152,307
VSA1	TOLKO	CORE_C	3,882	578,133	457,579
VSA1	TOLKO	CORE_D	0	0	0
VSA2	CANFOR	CONT_C	5,871	917,202	414,449
VSA2	CANFOR	CORE_C	16,148	2,775,649	577,029
VSA2	CANFOR	CORE_D	0	0	0
VSA2	DMI	CONT_D	3,401	266,796	553,498
VSA2	DMI	CORE_D	14,808	1,087,427	2,907,302
VSA2	ZAVISHA	CONT_C	1,864	322,311	100,711
VSA2	ZAVISHA	CORE_C	5,208	974,047	212,827
VSA2	ZAVISHA	CORE_D	0	0	0

Table 11. First period deciduous harvest profile.

OPERATOR	Core / Contingency Supply	Broad Cover Group	AVI Leading Species	Sum of Treed Area (ha)	Percent
DMI	CONT_D	D	Aw	3,591	79.3%
DMI	CONT_D	D	Bw	93	2.0%
DMI	CONT_D	DC	Aw	821	18.1%
DMI	CONT_D	DC	Pl	25	0.6%
	Contingency Total			**4,530**	
DMI	CORE_D	D	Aw	18,357	89.2%
DMI	CORE_D	D	Bw	24	0.1%
DMI	CORE_D	D	Pb	240	1.2%
DMI	CORE_D	DC	Aw	1,915	9.3%
DMI	CORE_D	DC	Bw	0	0.0%
DMI	CORE_D	DC	Pb	42	0.2%
DMI	CORE_D	DC	Sw	0	0.0%
	Core Total			**20,579**	
DMI	Total	D	Aw	21,948	87.4%
DMI	Total	D	Bw	117	0.5%
DMI	Total	D	Pb	240	1.0%
DMI	Total	DC	Aw	2,736	10.9%
DMI	Total	DC	Bw	0	0.0%
DMI	Total	DC	Pb	42	0.2%
DMI	Total	DC	Pl	25	0.1%
	P19 Total			**25,108**	

Table 12. Profile distribution of deciduous landbase available pool of contributing stands greater than 15metres tall by VSA.

		AVI Leading Species							
VSA	AVI Broad Cover Group	Aw	Bw	Lt	Pb	Pl	Sb	Sw	Total
VSA1	C					0	1	1	**2**
VSA1	CD							1	**1**
VSA1	D	56,263	2,573		1,000				**59,837**
VSA1	DC	18			0				**18**
VSA1 Totals		**56,282**	**2,573**	**0**	**1,000**	**0**	**1**	**1**	**59,858**
VSA2	C			0		32	53	131	**131**
VSA2	CD	12				76	2	111	**111**
VSA2	D	114,619	1,049		1,617				
VSA2	DC	14,176	264		225	25		109	**109**
VSA2 Totals		**128,807**	**1,313**	**0**	**1,842**	**133**	**55**	**351**	**132,500**
P19 Totals		**185,088**	**3,886**	**0**	**2,842**	**133**	**56**	**352**	**192,358**

		AVI Leading Species							
VSA	AVI Broad Cover Group	Aw	Bw	Fb	Pb	Pl	Sb	Sw	Total
VSA1	C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
VSA1	CD	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
VSA1	D	94.0%	4.3%	0.0%	1.7%	0.0%	0.0%	0.0%	**100.0%**
VSA1	DC	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
VSA1 Totals		**94.0%**	**4.3%**	**0.0%**	**1.7%**	**0.0%**	**0.0%**	**0.0%**	**100.0%**
VSA2	C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	**0.2%**
VSA2	CD	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	**0.2%**
VSA2	D	86.5%	0.8%	0.0%	1.2%	0.0%	0.0%	0.0%	**88.5%**
VSA2	DC	10.7%	0.2%	0.0%	0.2%	0.0%	0.0%	0.1%	**11.2%**
VSA2 Totals		**97.2%**	**1.0%**	**0.0%**	**1.4%**	**0.1%**	**0.0%**	**0.3%**	**100.0%**
P19 Totals		**96.2%**	**2.0%**	**0.0%**	**1.5%**	**0.1%**	**0.0%**	**0.2%**	**100.0%**

Deciduous contributing landbase with ostory height > 15m

Table 13. Period 1 Core conifer harvest profile.

OPERATOR	Core / Contingency Supply	AVI Broad Cover Group	AVI leading Species	Sum of Treed Area (ha)	Percent
CANFOR	CORE_C	C	Pl	12,604	80.1%
CANFOR	CORE_C	C	Sb	13	0.1%
CANFOR	CORE_C	C	Sw	2,059	13.1%
CANFOR	CORE_C	CD	Aw	36	0.2%
CANFOR	CORE_C	CD	Pl	686	4.4%
CANFOR	CORE_C	CD	Sw	89	0.6%
CANFOR	CORE_C	DC	Aw	245	1.6%
CANFOR	CORE_C	DC	Sw	7	0.0%
	Canfor Core Total			**15,739**	
TOLKO	CORE_C	C	Pl	835	21.5%
TOLKO	CORE_C	C	Sb	320	8.2%
TOLKO	CORE_C	C	Sw	995	25.6%
TOLKO	CORE_C	CD	Aw	115	3.0%
TOLKO	CORE_C	CD	Pb	10	0.3%
TOLKO	CORE_C	CD	Pl	9	0.2%
TOLKO	CORE_C	CD	Sw	298	7.7%
TOLKO	CORE_C	DC	Aw	1,300	33.5%
TOLKO	CORE_C	DC	Bw	0	0.0%
	Tolko Core Total			**3,882**	
ZAVISHA	CORE_C	C	Fb	0	0.0%
ZAVISHA	CORE_C	C	Pl	3,918	75.2%
ZAVISHA	CORE_C	C	Sb	19	0.4%
ZAVISHA	CORE_C	C	Sw	994	19.1%
ZAVISHA	CORE_C	CD	Aw	0	0.0%
ZAVISHA	CORE_C	CD	Pl	159	3.0%
ZAVISHA	CORE_C	CD	Sw	117	2.3%
	Zavisha Core Total			**5,207**	

Table 14. Period 1 Conifer Contingency harvest profile.

OPERATOR	Core / Contingency Supply	AVI Broad Cover Group	AVI leading Species	Sum of Treed Area (ha)	Percent
CANFOR	CONT_C	C	Aw	15	0.3%
CANFOR	CONT_C	C	Pl	3,572	60.8%
CANFOR	CONT_C	C	Sb	314	5.3%
CANFOR	CONT_C	C	Sw	441	7.5%
CANFOR	CONT_C	CD	Aw	162	2.8%
CANFOR	CONT_C	CD	Pl	76	1.3%
CANFOR	CONT_C	CD	Sw	316	5.4%
CANFOR	CONT_C	DC	Aw	975	16.6%
	Canfor Contingency Total			**5,871**	
TOLKO	CONT_C	C	Pl	217	14.4%
TOLKO	CONT_C	C	Sb	186	12.3%
TOLKO	CONT_C	C	Sw	368	24.4%
TOLKO	CONT_C	CD	Aw	57	3.8%
TOLKO	CONT_C	CD	Pl	12	0.8%
TOLKO	CONT_C	CD	Sb	21	1.4%
TOLKO	CONT_C	CD	Sw	148	9.8%
TOLKO	CONT_C	DC	Aw	484	32.1%
TOLKO	CONT_C	DC	Sw	14	0.9%
	Tolko Contingency Total			**1,505**	
ZAVISHA	CONT_C	C	Pl	1,401	75.2%
ZAVISHA	CONT_C	C	Sb	33	1.7%
ZAVISHA	CONT_C	C	Sw	138	7.4%
ZAVISHA	CONT_C	CD	Aw	48	2.6%
ZAVISHA	CONT_C	CD	Sw	25	1.4%
ZAVISHA	CONT_C	DC	Aw	219	11.7%
	Zavisha Contingency Total			**1,864**	

Table 15. Profile distribution of conifer landbase available pool of contributing stands greater than 15metres tall by VSA.

		AVI Leading Species							
VSA	AVI Broad Cover Group	Aw	Bw	Fb	Pb	Pl	Sb	Sw	Total
VSA1	C			9		7,368	883	7,865	**16,125**
VSA1	CD	108				74	17	1,449	**1,648**
VSA1	D	963			14				**977**
VSA1	DC	5,304	24		23	38		20	**5,409**
VSA1 Totals		**6,375**	**24**	**9**	**37**	**7,480**	**900**	**9,334**	**24,159**
VSA2	C			249		42,204	1,789	34,600	**78,841**
VSA2	CD	350		12		3,273	3	7,159	**10,796**
VSA2	D	913							**913**
VSA2	DC	10,053	76		14			2	**10,145**
VSA2 Totals		**11,315**	**76**	**261**	**14**	**45,477**	**1,792**	**41,760**	**100,696**
P19 Totals		**17,690**	**101**	**270**	**51**	**52,957**	**2,692**	**51,095**	**124,855**

		AVI Leading Species							
VSA	AVI Broad Cover Group	Aw	Bw	Fb	Pb	Pl	Sb	Sw	Total
VSA1	C	0.0%	0.0%	0.0%	0.0%	30.5%	3.7%	32.6%	**66.7%**
VSA1	CD	0.4%	0.0%	0.0%	0.0%	0.3%	0.1%	6.0%	**6.8%**
VSA1	D	4.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	**4.0%**
VSA1	DC	22.0%	0.1%	0.0%	0.1%	0.2%	0.0%	0.1%	**22.4%**
VSA1 Totals		**26.4%**	**0.1%**	**0.0%**	**0.2%**	**31.0%**	**3.7%**	**38.6%**	**100.0%**
VSA2	C	0.0%	0.0%	0.2%	0.0%	41.9%	1.8%	34.4%	**78.3%**
VSA2	CD	0.3%	0.0%	0.0%	0.0%	3.3%	0.0%	7.1%	**10.7%**
VSA2	D	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.9%**
VSA2	DC	10.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	**10.1%**
VSA2 Totals		**11.2%**	**0.1%**	**0.3%**	**0.0%**	**45.2%**	**1.8%**	**41.5%**	**100.0%**
P19 Totals		**14.2%**	**0.1%**	**0.2%**	**0.0%**	**42.4%**	**2.2%**	**40.9%**	**100.0%**

Conifer contributing landbase, ostory height > 15m

Table 16. First Period Harvest sequence profile by pathway.

Area Scheduled for Harvest By Pathway in Period 1																					
			Age of Scheduled Stand																		
VSA	Pathway Number	Pathway Name	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	Total Area	Total Percent
VSA1	1	Aspen>>Shrub		7	9		23													**39**	**0.1%**
VSA1	10	Pine-WhiteSpruce	3	5	295	174	200	166	369	99	84	72	85	29	222					**1,802**	**5.7%**
VSA1	12	BlackSpruce-Pine/Whitespruce	0		0	0	12	1	0											**14**	**0.0%**
VSA1	2	Aspen>>WhiteSpruce			175	229	180	310	445	329			40	54	121					**1,884**	**5.9%**
VSA1	3	Aspen>>LateMixed>>WhiteSpruce		213	362	164	53	174	440	234	24	94	110	17	59				1	**1,946**	**6.1%**
VSA1	4	Aspen>>EarlyMixed>>WhiteSpruce		173	420	306	561	452	1,176	242	48	105	126	199	867		8		16	**4,698**	**14.8%**
VSA1	5	AspenMixed>>WhiteSpruce			449	183	121	189	509	1,059	118	354	919							**3,900**	**12.3%**
VSA1	6	Wspruce>>WhiteSpruce			0	10	58	134	1,154	329	111	150	574	320	432			46	8	**3,327**	**10.5%**
VSA1	7	Pine	37	1,770	6,695	559	657	252	477	118	170	131	15		17					**10,899**	**34.4%**
VSA1	8	Pine-BlackSpruce-Deciduous			0		45	6	51		31	34	72	2	80					**321**	**1.0%**
VSA1	9	Deciduous-Pine-BlackSpruce	53	197	1,427	461	180	194	244	56	22		15		42					**2,890**	**9.1%**
VSA1 Total Area (ha)			**93**	**2,364**	**9,833**	**2,087**	**2,090**	**1,877**	**4,866**	**2,466**	**609**	**939**	**1,955**	**622**	**1,840**	**0**	**8**	**46**	**26**	**31,719**	
VSA2 Total Percent			**0.3%**	**7.5%**	**31.0%**	**6.6%**	**6.6%**	**5.9%**	**15.3%**	**7.8%**	**1.9%**	**3.0%**	**6.2%**	**2.0%**	**5.8%**	**0.0%**	**0.0%**	**0.1%**	**0.1%**		
VSA2	1	Aspen>>Shrub	32	4	21	60	14	80	152	90	37		7							496	0.4%
VSA2	10	Pine-WhiteSpruce	12	245	653	581	660	2,520	5,336	1,766	1,009	2,366	754	299	239	207		27		16,675	14.0%
VSA2	12	BlackSpruce-Pine/Whitespruce		0	10	237	191	245	958	157	81	257	16	120	0					2,274	1.9%
VSA2	2	Aspen>>WhiteSpruce			16	608	173	372	826	485	513	12	46	20	20	100	14			3,204	2.7%
VSA2	3	Aspen>>LateMixed>>WhiteSpruce	0	87	167	193	139	413	757	910	851	70	231	109	27	181				4,136	3.5%
VSA2	4	Aspen>>EarlyMixed>>WhiteSpruce	0	287	400	205	318	767	1,440	1,129	901	742	735	876	133	399		53		8,385	7.0%
VSA2	5	AspenMixed>>WhiteSpruce		215	557	459	280	760	1,063	2,198	2,635	2,191	1,299	2						11,659	9.8%
VSA2	6	Wspruce>>WhiteSpruce	3	21	387	627	364	2,090	5,943	3,614	1,814	1,849	2,387	1,446	410	661	4	44		21,664	18.2%
VSA2	7	Pine	124	4,315	503	2,988	2,202	11,362	13,161	1,810	578	1,015	247	650	361	59		74		39,450	33.1%
VSA2	8	Pine-BlackSpruce-Deciduous		564	29	710	171	904	1,417	445	377	405	128	53	36	23				5,262	4.4%
VSA2	9	Deciduous-Pine-BlackSpruce	86	521	480	412	486	2,217	1,046	197	282	100	11	0						5,837	4.9%
VSA2 Total Area (ha)			**258**	**6,259**	**3,224**	**7,079**	**4,998**	**21,730**	**32,099**	**12,802**	**9,078**	**9,007**	**5,860**	**3,575**	**1,226**	**1,631**	**18**	**199**	**0**	**119,042**	
VSA1 Total Percent			**0.2%**	**5.3%**	**2.7%**	**5.9%**	**4.2%**	**18.3%**	**27.0%**	**10.8%**	**7.6%**	**7.6%**	**4.9%**	**3.0%**	**1.0%**	**1.4%**	**0.0%**	**0.2%**	**0.0%**		
P19 Total Area (ha)			**351**	**8,623**	**13,056**	**9,166**	**7,088**	**23,607**	**36,965**	**15,268**	**9,686**	**9,946**	**7,815**	**4,197**	**3,066**	**1,631**	**26**	**245**	**26**	**150,761**	
P19 Total Percent			**0.2%**	**5.7%**	**8.7%**	**6.1%**	**4.7%**	**15.7%**	**24.5%**	**10.1%**	**6.4%**	**6.6%**	**5.2%**	**2.8%**	**2.0%**	**1.1%**	**0.0%**	**0.2%**	**0.0%**		

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9: Allocation of Annual Allowable Cuts

The forecast AACs determined in the forecasting section were used to calculate individual company allocations. The allocations were calculated to reflect the new P19 amalgamated FMU.

9.1 Historic AAC

Table 17. Historic allocations

Historical Coniferous Allocations									
	FMU	Company	Dispositon	%	AAC	Sub total	%	AAC	Totals
VSA 1	P10	DMI	FMA0900045		20,028		32.8328%	20028	
	P10	Tolko	CTQP100001	67.1672%	40,972	61,000	67.1672%	40,972	61,000
VSA 2	P13	DMI	FMA0900045		38485		13.4427%	38485	
	P13	Canfor	CTQP130002	69.9700%	162281		56.6843%	162281	
	P13	Canfor	CTQP130004	6.3000%	14605		5.1015%	14605	
	P13	Zavisha	CTQP130005	7.1000%	16469	231,840	5.7526%	16469	
	P17	Zavisha	CTQP170001	35.7200%	19449		6.7935%	19449	
	P17	Canfor	CTQP170002	64.2800%	35000	54,449	12.2254%	35000	286,289

The allocation attempts to maintain each conifer company's original business position as much as possible. For example, Tolko & DMI traditionally held 100% of the conifer cut in the old FMU P10 (now VSA1). VSA1 was defined specifically to enable allocation of AAC on that portion of the landbase to Tolko & DMI only. Conversely, Tolko will not receive conifer AAC in VSA2. The conifer companies want to maintain their traditional spheres of operations as much as possible. The arrangement of VSAs and the matching rules in the TSA calculations aid in this goal.

DMI historically held 100% of deciduous harvest AAC.

9.2 AAC Splits

The AAC from the forecasting process was split into AAC percentages based on percentage of the total cut in FMU P19. The process uses the new AAC numbers to fairly distribute existing forest conditions (and their resultant AAC impacts) on the company traditionally operating in an area. A company area that contributes more to the new AAC will provide those rewards to the company originally holding rights there. Also, using the new AACs makes translation to a spatial sequence much easier.

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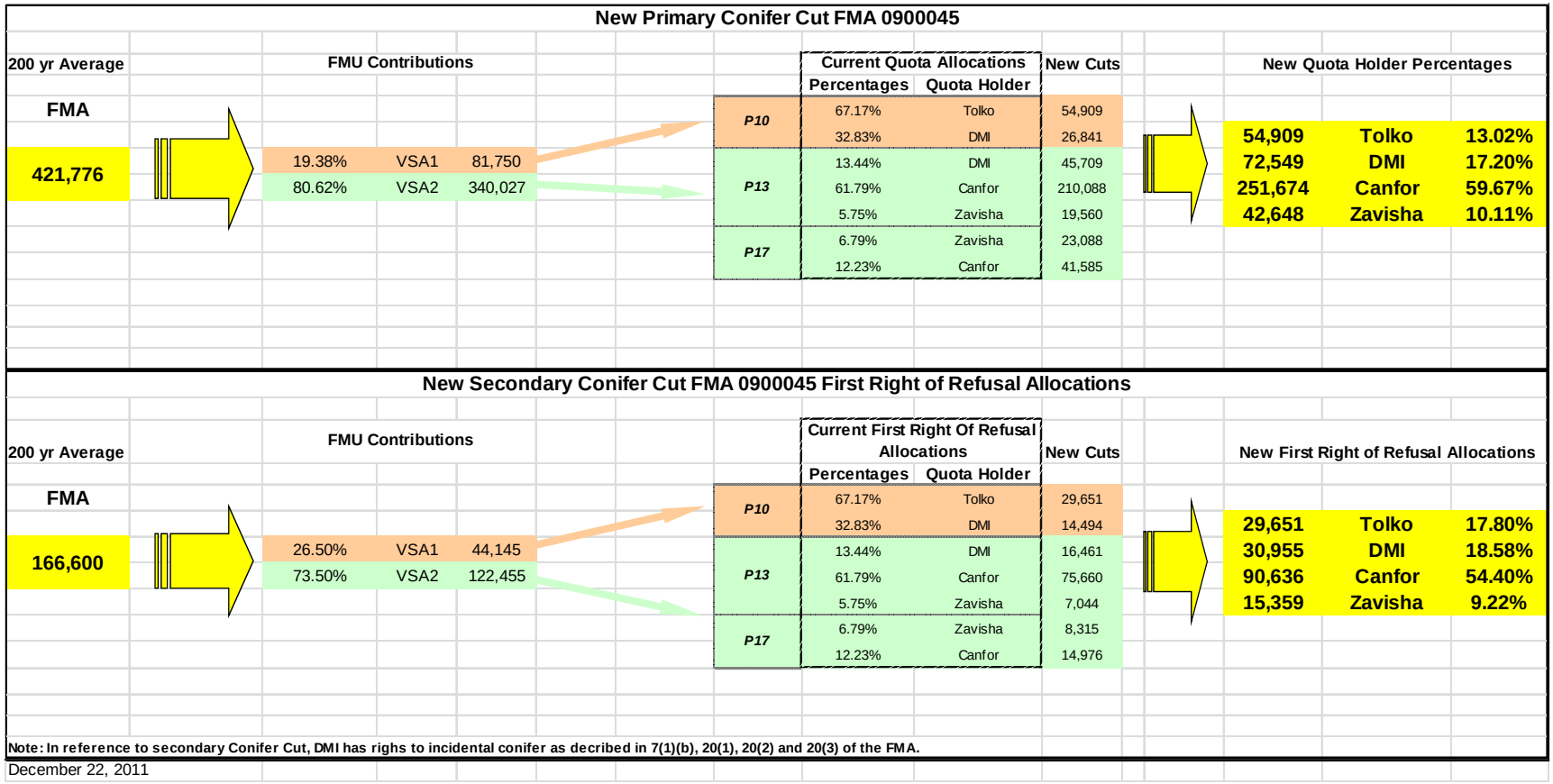


Figure 19. AAC Allocation Procedure for FMA0900045. Historic AAC splits are applied to the new TSA results and weighted into a combined P19 split percentage.

Table 18. Preferred Spatial Harvest Sequence (Nov 24, 2011) spatial playback results showing average AACs used in amalgamated split calculations and determining the proposed AACs.l

NAME	Core / Contingency	Primary / Secondary	Conifer / Deciduous	VSA	PERIOD1	Period 2 - 7 60 year average	Period 1 - 7 70 year average	Period 1 - 20 200 year average
Contingency Deciduous whole forest	Contingency	Secondary	Deciduous	P19	26,356	21,167	21,908	20,190
	Contingency	Primary	Deciduous	P19	78,288	78,300	78,298	78,756
	Contingency	Total	Deciduous	P19	104,645	99,467	100,206	98,946
Core Deciduous whole forest	Core	Secondary	Deciduous	P19	165,161	82,397	94,221	121,242
	Core	Primary	Deciduous	P19	423,555	423,553	423,553	416,100
	Core	Total	Deciduous	P19	588,716	505,951	517,774	537,342
Contingency Conifer VSA1	Contingency	Secondary	Conifer	VSA1 (north)	573	16,829	14,507	**9,398**
	Contingency	Primary	Conifer	VSA1 (north)	22,662	24,420	24,169	**24,985**
	Contingency	Total	Conifer	VSA1 (north)	23,234	41,250	38,676	34,384
Core Conifer VSA1	Core	Secondary	Conifer	VSA1 (north)	36,408	51,784	49,587	**34,747**
	Core	Primary	Conifer	VSA1 (north)	57,816	57,804	57,805	**56,764**
	Core	Total	Conifer	VSA1 (north)	94,223	109,588	107,393	91,511
Contingency Conifer VSA2	Contingency	Secondary	Conifer	VSA2 (south)	18,592	32,090	30,162	**19,287**
	Contingency	Primary	Conifer	VSA2 (south)	123,951	130,988	129,983	**138,323**
	Contingency	Total	Conifer	VSA2 (south)	142,542	163,078	160,145	157,611
Core Conifer VSA2	Core	Secondary	Conifer	VSA2 (south)	116,849	141,783	138,221	**103,168**
	Core	Primary	Conifer	VSA2 (south)	374,987	192,846	218,866	**201,704**
	Core	Total	Conifer	VSA2 (south)	491,835	334,628	357,086	304,871
Total Conifer	Core + Contingency	Total	Conifer	VSA1 (north)	117,457	150,837	146,069	125,895
	Core + Contingency	Total	Conifer	VSA2 (south)	634,378	497,707	517,231	462,482
	Core + Contingency	Total	Conifer	P19	751,835	648,544	663,300	588,377
Total Harvest Volume	Core + Contingency	Total	Deciduous	P19	693,360	605,417	617,981	636,288
	Core + Contingency	Total	Conifer	P19	751,835	648,544	663,300	588,377
	Core + Contingency	Total	Both Species	P19	1,445,195	1,253,961	1,281,280	1,224,665
Total Primary Harvest Volume	Core + Contingency	Primary	Deciduous	P19	501,843	501,853	501,852	494,856
	Core + Contingency	Primary	Conifer	P19	579,414	406,058	430,823	**421,776**
	Core + Contingency	Primary	Both Species	P19	1,081,257	907,911	932,675	916,632
Total Secondary Harvest Volume	Core + Contingency	Secondary	Deciduous	P19	191,517	103,564	116,129	141,432
	Core + Contingency	Secondary	Conifer	P19	172,420	242,486	232,477	**166,600**
	Core + Contingency	Secondary	Both Species	P19	363,938	346,050	348,606	308,033

The conifer splits were calculated separately for primary and secondary volume.

The steps in the calculation depicted in Figure 19 are as follows for both primary and secondary volumes:

1. Determine the 200 year average of the Primary Conifer AAC from *Table 9. Forecast Annual Allowable Cuts from Spatial Playback (Nov 24, 2011 Final Run)* The resultant averages are presented in Table 18.
2. The current % split between 200 year average AAC contributed by each VSA is calculated (e.g. 19.38% of the total 200 year average AAC comes from VSA1)
3. Each historic tenure % is multiplied by the VSA volume contribution to derive a new tenure volume.
4. Each company's collective tenure volumes are summed to derive the company's new volume.
5. The company volumes are expressed in terms of a percentage of all company volumes in the whole of P19. The new AAC splits are presented in Table 19. Final Conifer AAC splits for FMU P19.

Table 19. Final Conifer AAC splits for FMU P19.

P19 Conifer Splits		
Company	**Primary**	**Secondary**
Tolko	13.02%	17.80%
DMI	17.20%	18.58%
Canfor	59.67%	54.40%
Zavisha	10.11%	9.22%

DMI receives 100% of the deciduous harvest AAC in FMU P19.

9.3 Proposed Annual Allowable Cuts

This submission seeks approval of the forecast preferred harvest scenario (Nov 24 2011 run). The companies have an internal Volume Supply Agreement that will be used to implement the harvest levels set out in this plan approval. The volume supply agreement will guide the companies in allocating blocks and directing wood to facilities but the agreement itself is not part of the approval of this submission nor will the ongoing approval of this DFMP be affected by the status of the volume supply agreement.

The conifer AAC proposed is the first period spatial sequence volume. The conifer AAC will then assume the period 2-7 sixty year average. This will ensure that

the goals of the TSA calculation are consistent and the volume supply agreement may be implemented as designed.

The deciduous AAC proposed is the 1st period spatial sequence volume. The deciduous AAC will then assume the period 2-7 sixty year average. The rationale is as follows:

- The Volume Supply Agreement places huge importance on secondary conifer. In order to effectively manage this trade with Zavisha and Canfor, it is necessary for the first period AAC to match the sequence volume. If the 70 year average AAC was assigned, then the conifer holders would be entitled to cut more in the first period than the spatial sequence contains (the average is greater than the 1st period). It would be far easier to administer if the AAC matched the spatial sequence volume.
- The core primary AAC for the first period is virtually identical to the 70 year average – there is no risk to ASRD in allowing this.
- The VSA2 core conifer surge cut will produce a significantly different secondary deciduous cut in the 1st period than the 70 year average would predict. Again, it is desirable for the AAC to match the spatial sequence.

Table 20 summarizes the proposed conifer AACs. Table 21 summarizes the proposed deciduous AACs.

Table 20. Proposed Conifer Annual Allowable Cuts. Percent splits are expressed as the 200year average on the combined P19 AAC.

		Proposed Conifer AAC Period 1 (2009-2018)								
		Primary			Secondary			Total		
		Core	**Contingency**	**Total**	**Core**	**Contingency**	**Total**	**Core**	**Contingency**	**Total**
2009 - 2018	VSA1	57,816	22,662	80,478	36,408	573	36,981	94,223	23,234	117,457
	VSA2	374,987	123,951	498,938	116,849	18,592	135,441	491,835	142,542	634,378
	P19	432,803	146,613	579,416	153,257	19,165	172,422	586,058	165,776	751,835
	Tolko	13.02%	13.02%	13.02%	17.80%	17.80%	17.80%			
		56,351	19,089	75,440	27,280	3,411	30,691	83,631	22,500	106,131
	DMI	17.20%	17.20%	17.20%	18.58%	18.58%	18.58%			
		74,442	25,217	99,660	28,475	3,561	32,036	102,917	28,778	131,696
	Canfor	59.67%	59.67%	59.67%	54.40%	54.40%	54.40%			
		258,254	87,484	345,738	83,372	10,426	93,798	341,625	97,910	439,535
	Zavisha	10.11%	10.11%	10.11%	9.22%	9.22%	9.22%			
		43,756	14,823	58,579	14,130	1,767	15,897	57,887	16,590	74,476

		Proposed Conifer AAC Period 2-7 (2019-2078)								
		Primary			Secondary			Total		
		Core	**Contingency**	**Total**	**Core**	**Contingency**	**Total**	**Core**	**Contingency**	**Total**
2019-2078	VSA1	57,804	24,420	82,224	51,784	16,829	68,613	109,588	41,249	150,837
	VSA2	192,846	130,988	323,834	141,783	32,090	173,873	334,629	163,078	497,707
	P19	250,650	155,408	406,058	193,567	48,919	242,486	444,217	204,327	648,544
	Tolko	13.02%	13.02%	13.02%	17.80%	17.80%	17.80%			
		32,635	20,234	52,869	34,455	8,708	43,163	67,090	28,942	96,031
	DMI	17.20%	17.20%	17.20%	18.58%	18.58%	18.58%			
		43,112	26,730	69,842	35,965	9,089	45,054	79,077	35,819	114,896
	Canfor	59.67%	59.67%	59.67%	54.40%	54.40%	54.40%			
		149,563	92,732	242,295	105,300	26,612	131,912	254,863	119,344	374,207
	Zavisha	10.11%	10.11%	10.11%	9.22%	9.22%	9.22%			
		25,341	15,712	41,052	17,847	4,510	22,357	43,188	20,222	63,410

Table 21. Proposed Deciduous Annual Allowable Cut

	Proposed Deciduous AAC (2009-2078)								
	Primary			Secondary			Total		
	Core	Contingency	Total	Core	Contingency	Total	Core	Contingency	Total
Period 1 2009-2018	423,555	78,288	501,843	165,161	26,356	191,517	588,716	104,644	693,360
Period 2-7 2019-2078	423,553	78,300	501,853	82,397	21,167	103,564	505,950	99,467	605,417

9.4 Period 1 Conifer Core Surge Cut VSA1

The selected preferred management strategy targeted primary conifer stands containing pine content. The conifer operators in VSA1 prescheduled most available stands in the core supply of the first period in VSA1. This resulted in a non-even flow scenario being proposed as the approved plan.

The first period surge was approved in principle as a valid pine strategy. ASRD requested that the AAC be presented as a non-even flow scenario in this submission. This is accomplished in Table 20 and Table 21.

The conifer operators requested that the surge be explained for future reference. A comparative model run was completed that calculated the evenflow conifer harvest without the extra prescheduled pine. The first period VSA2 core primary conifer surge was defined as:

> (period 1 volume from proposed SHS) – (period1..20 even flow volume from non-surge scenario)

.Thus, an even flow conifer cut for all periods was calculated at 192,853. The surge was calculated at 182,134 m3/year.

Table 22 shows the proposed conifer AAC with the surge highlighted. The surge only exists in VSA2 core primary conifer stands. **Table 22 is shown here for reference only – the surge volume will not appear in the official tenure documents relating to AAC. The official tenure documents will simply show the total cut levels for the first period and then the subsequent even flow numbers.**

Table 22. Proposed Conifer AAC showing the Core Pine Surge in VSA1.

	Proposed Conifer AAC Period 1 (2009-2018)										
	Primary					Secondary			Total		
	Core	Core Pine Surge	Core Total	Contingency	Total	Core	Contingency	Total	Core	Contingency	Total
VSA1	57,816	0	57,816	22,662	80,478	36,408	573	36,981	94,223	23,234	117,457
VSA2	192,853	182,134	374,987	123,951	498,938	116,849	18,592	135,441	491,835	142,542	634,378
P19	250,669	182,134	432,803	146,613	579,416	153,257	19,165	172,422	586,058	165,776	751,835
Tolko		0.00%	13.02%	13.02%	13.02%	17.80%	17.80%	17.80%			
	0	0	56,351	19,089	75,440	27,280	3,411	30,691	83,631	22,500	106,131
DMI	17.20%	17.20%		17.20%	17.20%	18.58%	18.58%	18.58%			
	43,115	31,327	74,442	25,217	99,660	28,475	3,561	32,036	102,917	28,778	131,696
Canfor	59.67%	59.67%		59.67%	59.67%	54.40%	54.40%	54.40%			
	149,574	108,679	258,254	87,484	345,738	83,372	10,426	93,798	341,625	97,910	439,535
Zavisha	10.11%	10.11%		10.11%	10.11%	9.22%	9.22%	9.22%			
	25,343	18,414	43,756	14,823	58,579	14,130	1,767	15,897	57,887	16,590	74,476

9.5 Conifer Spatial Allocation

Table 23 presents the results of the final step – spatial allocation. The allocation attempts to match the VSA concept that keeps conifer companies in their traditional territories. Only primary volume is spatially allocated. The allocation targets were calculated using the current quota allocations for each VSA (found in Figure 19).

Table 23 shows the spatial allocation targets by VSA. Table 24 shows the achieved spatial allocation. The spatial allocation is contained in the 10year, 20year, and 70year spatial sequence layers in the geodatabase called “west_pfhs2009.gdb”.

9.6 Deciduous Spatial Allocation

All Primary and Secondary deciduous is allocated to DMI. All deciduous allocations shown in Table 24 (summary of the 1st period spatial sequence) are assigned to DMI.

Table 23. Spatial Allocation Targets of Primary Conifer 1st period AAC.

		Spatial Allocation Targets for Primary Conifer Harvest Volumes Period 1 (2009-2018)								
		Primary			Secondary			Total		
		Core	Contingency	Total	Core	Contingency	Total	Core	Contingency	Total
VSA1 (north)	**VSA1 AAC from Period1 Spatial Sequence**	**57,816**	**22,662**	**80,478**	**36,408**	**573**	**36,981**	**94,223**	**23,234**	**117,457**
	Tolko	67.17%	67.17%	67.17%	67.17%	67.17%	67.17%			
		38,835	15,222	54,057	24,455	385	24,840	63,290	15,607	78,897
	DMI	32.83%	32.83%	32.83%	32.83%	32.83%	32.83%			
		18,981	7,440	26,421	11,953	188	12,141	30,934	7,628	38,562
	Tolko's Use	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%			
		57,816	22,662	80,478	36,408	573	36,981	94,224	23,235	117,459
VSA2 (south)	**VSA2 Conifer AAC from Period1 Spatial Sequence**	**374,987**	**123,951**	**498,938**	**116,849**	**18,592**	**135,441**	**491,835**	**142,542**	**634,378**
	Canfor	74.02%	74.02%	74.02%	74.02%	74.02%	74.02%			
		277,565	91,749	369,314	86,492	13,762	100,253	364,057	105,510	469,567
	DMI	13.44%	13.44%	13.44%	13.44%	13.44%	13.44%			
		50,398	16,659	67,057	15,705	2,499	18,203	66,103	19,158	85,261
	Zavisha	12.54%	12.54%	12.54%	12.54%	12.54%	12.54%			
		47,023	15,543	62,567	14,653	2,331	16,984	61,676	17,875	79,551
	Zavisha's Use	25.98%	25.98%	25.98%	25.98%	25.98%	25.98%			
		97,422	32,202	129,624	30,357	4,830	35,188	127,779	37,033	164,812
	*Note : Secondary volumes are shown in this table but they have not been spatially allocated. Decisions on use and direction of secondary conifer volume will occur during annual planning processes.									

Table 24. Summary of first period spatially allocated harvest volumes for FMU P19.

West FMA Preferred Spatial Havest Sequence - Period 1 (2009-2018) Harvest Volumes									
Deciduous Harvest Volume									
VSA	Core Primary Deciduous	Contingency Primary Deciduous	Core + Contingency Total Primary	Core Secondary Deciduous	Contingency Secondary Deciduous	Core + Contingency Secondary Deciduous	Core Total Deciduous	Contingency Total Deciduous	All Sources Total Deciduous
VSA 1	1,328,080	229,374	1,557,454	457,579	152,307	609,886	1,785,659	381,681	2,167,340
VSA2	2,907,302	553,498	3,460,800	789,856	515,160	1,305,016	3,697,158	1,068,658	4,765,816
P19 Total	**4,235,382**	**782,872**	**5,018,254**	**1,247,435**	**667,467**	**1,914,902**	**5,482,817**	**1,450,339**	**6,933,156**
Conifer Harvest Volume									
VSA	Core Primary Conifer	Contingency Primary Conifer	Core + Contingency Total Primary	Core Secondary Conifer	Contingency Secondary Conifer	Core + Contingency Secondary Conifer	Core Total Conifer	Contingency Total Conifer	All Sources Total Conifer
VSA 1	578,133	226,611	804,744	326,017	43,701	369,718	904,150	270,312	1,174,462
VSA2	3,749,696	1,239,513	4,989,209	1,087,427	266,796	1,354,223	4,837,123	1,506,309	6,343,432
P19 Total	**4,327,829**	**1,466,124**	**5,793,953**	**1,413,444**	**310,497**	**1,723,941**	**5,741,273**	**1,776,621**	**7,517,894**

9.6.1 Official AAC vs Volume Supply Area Spatial Allocation

ASRD has an administrative requirement that prevents the companies from directly defining AACs that are consistent with the Volume Supply Area concept. The amalgamation of FMUs requires that AAC be expressed as a percentage of the total amalgamated FMU. This was done using 200 year average AACs to determine percent AAC splits that are applied to the first period spatial sequence results.. The first period AACs do not match the 200 year average and therefore the relative amount of AAC in VSA1 vs VSA2 does not exactly match.

The spatial allocation is calculated following the VSA concept applied to the first period spatial sequence. The official conifer AAC's are presented in Table 20 and are repeated at the heading of Table 22 Table 23. The calculated values in Table 23 are the target volumes by company as agreed to between the companies in the effort to implement Volume Supply Areas. The companies will operate at these levels in these VSAs by cooperatively managing the blocks and which AAC the harvests get charged to.

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10: Comparison to Existing Plan

The Forecasting Document presented the following analysis that compared the 200 year average to the existing allocations. This allowed general comparison of long term productivity change being forecast. This section presents a comparison between the existing allocations and the proposed AACs.

FMU P19 is a recent amalgamation. The AAC currently applied is a mixture from two previous plans. The lands covered by what was the west portion of FMA8900027 (P10 & P13) were included in the approved 2007 DMI DFMP. The lands covered by the former FMU P1N were included in the P15 TSA. Upon dissolution of P15, the former P1N part was amalgamated into the new P19. The area weighted AAC from the P15 analysis was used to calculate the cuts.

In 2008, ASRD approved the DFMP for P13 & P10 but did not allocate the AAC. Consequently, the AAC for those lands are derived from the 1999 AAC. So, as of today, the AAC for P19 is derived from a 1999 TSA and the P15 TSA.

Table 25. Currently applied annual allowable cuts in P19.

Current AAC in P19									
Historical Coniferous Allocations									
	FMU	**Company**	**Dispositon**	**%**	**AAC**	**Sub total**	**%**	**AAC**	**Totals**
	P10	DMI	FMA0900045		20,028		32.8328%	20,028	
VSA 1	P10	Tolko	CTQP100001	67.1672%	40,972	61,000	67.1672%	40,972	**61,000**
	P13	DMI	FMA0900045		38485		13.4427%	38,485	
	P13	Canfor	CTQP130002	69.9700%	162281		56.6843%	162,281	
VSA2	P13	Canfor	CTQP130004	6.3000%	14605		5.1015%	14,605	
	P13	Zavisha	CTQP130005	7.1000%	16469	231,840	5.7526%	16,469	
	P17	Zavisha	CTQP170001	35.7200%	19449		6.7935%	19,449	
	P17	Canfor	CTQP170002	64.2800%	35000	54,449	12.2254%	35,000	**286,289**
								P19 Total	**347,289**
Current Deciduous Allocations									
	FMU	Company	Dispositon	%	AAC				
	P19	DMI	FMA0900045	100	415,682				
* Note: These AACs have had retention removed - retention is not charges against the cut.									

The proposed AACs are presented in Table 26 and Table 27. These numbers may be adjusted for operational planning of recurring intermittent streams but they serve to illustrate the magnitude of difference between the current allocation and the new.

Table 26. Proposed AACs for FMU P19 Period 1.

Proposed AAC for FMU P19 in Period 1 (2009-2018)					
	Primary Conifer		Secondary Conifer		Total Conifer
Company	Percent of new amalgamated P19	Volume	Percent of new amalgamated P19	Volume	Volume
Tolko	13.02%	75,440	17.80%	30,691	**106,131**
DMI	17.20%	99,660	18.58%	32,036	**131,696**
Canfor	59.67%	345,738	54.40%	93,798	**439,536**
Zavisha	10.11%	58,579	9.22%	15,897	**74,476**
Total Primary Volume		**579,417**	**Total Secondary Volume**	**172,422**	**751,839**
Company	Primary Deciduous		Secondary Deciduous		Total Deciduous
	Percent	Volume	Percent	Volume	Volume
DMI	100%	**501,843**	100%	**191,517**	**693,360**

Table 27. Proposed AACs for FMU P19 Period 2-7.

Proposed AAC for FMU P19 in Period 2-7 (2019-2078)					
	Primary Conifer		Secondary Conifer		Total Conifer
Company	Percent of new amalgamated P19	Volume	Percent of new amalgamated P19	Volume	Volume
Tolko	13.02%	52,869	17.80%	43,163	**96,032**
DMI	17.20%	69,842	18.58%	45,054	**114,896**
Canfor	59.67%	242,295	54.40%	131,912	**374,207**
Zavisha	10.11%	41,052	9.22%	22,357	**63,409**
Total Primary Volume		**406,058**	**Total Secondary Volume**	**242,486**	**648,544**
Company	Primary Deciduous		Secondary Deciduous		Total Deciduous
	Percent	Volume	Percent	Volume	Volume
DMI	100%	**501,853**	100%	**103,564**	**605,417**

	AAC	Current Allocation	Proposed AAC	Difference Volume	Difference Volume Adjusted for Retention	Difference Percent Adjusted for Retention
200 year average	Deciduous	415,682	636,288	220,606	125,163	30%
	Conifer	347,289	588,382	241,093	152,836	44%
	Total	762,971	1,224,670	461,699	277,999	36%
Period 1 (2009-2018)	Deciduous	415,682	693,360	277,678	173,674	42%
	Conifer	347,289	751,835	404,546	291,771	84%
	Total	762,971	1,445,195	682,224	465,445	61%
Period 2-7 (2019-2078)	Deciduous	415,682	605,417	189,735	98,922	24%
	Conifer	347,289	648,544	301,255	203,973	59%
	Total	762,971	1,253,961	490,990	302,896	40%
	* The current allocations have 15% retention removed. The new allocations do not have retention removed. The percent difference has been adjusted 15% to make a fair					

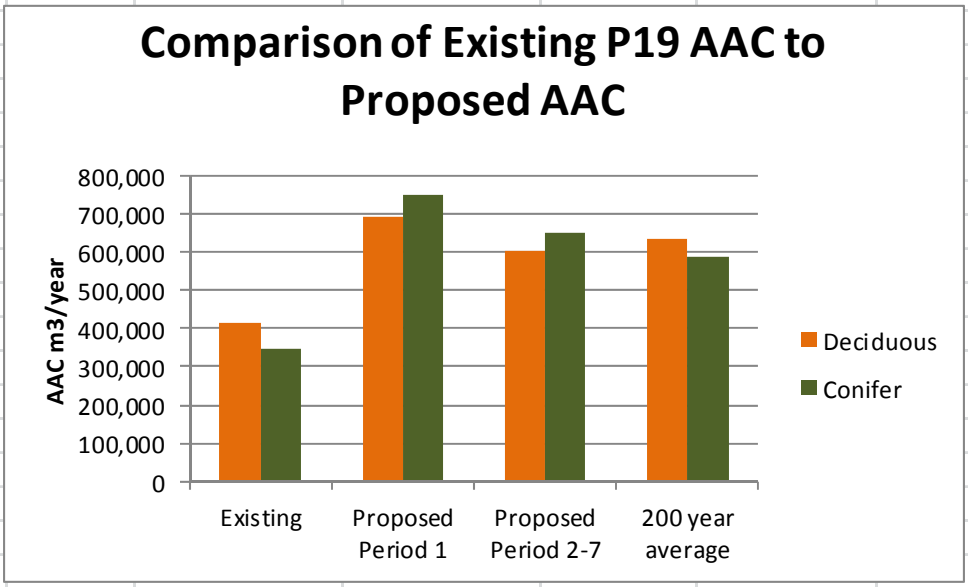


Figure 20. Comparison of existing AAC allocations in P19 to the Proposed AAC for P19.

Figure 20 shows:

- 24% increase in deciduous AAC in the medium term (70 years)
- 30% increase in deciduous AAC over 200 years including the 1st period surge.

- Roughly 15% increase in period 1 deciduous AAC from the conifer surge.
- 61% increase in conifer AAC in the medium term.
- 84% increase in conifer AAC in the 1st period surge.

10.1 Performance of Last Plan

The current allocations are implemented on the 2007 spatial harvest sequence up to the historic AAC levels. The start-date of the new plan is 2009, thus only 3 years had expired on the 2007 plan. The work for this plan is completely fresh – no attempt was made to compare to the past. The VOITs presented represent forest performance to date and covers the short life span of the 2007 plan.

10.1.1 Pine Beetle

The mountain pine beetle epidemic has dominated conifer harvest and planning for the past 5 years. Harvest sequence, retention strategies and utilization have all been greatly altered from the past plans. The differences are so great as to make a comparison to the past plan of little use. This new plan accounts for beetle and looks forward, taking its impact into account.

10.2 Significant Events Impacting Planning

10.2.1 Landbase Change

- The landbase has significantly changed. P1N has been added. P13, P11, P1N, and P10 have been amalgamated.
- Large fires from the 1980's have come back into the net landbase
- Grazing dispositions have been removed

10.2.2 Inventory Change

- There is a new AVI inventory for the entire forest.
    - The forest appears to be younger than in previous inventories
        - Forest appears more productive
- P1N previously did not have AVI.
- There are new sample plots and new yield curves values

10.2.3 Strategy Change

The overall management approach is not significantly different from the past but there are changes in the TSA scenario:

- Amalgamated unit for deciduous calculation
- Maximize primary harvests while allowing secondary to float
- Preschedule of 10 years of harvest
- Large conifer pine beetle surge cut
- Old cutblocks stratified onto ARIS declarations rather than onto known trajectories.
- Core/Contingency is implemented
- Watershed ECA constraints added

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11: Timber Depletion Accounting

All harvested timber volumes will be reported to Alberta as required for production and dues payment. Weigh scale measures will be used for conifer and deciduous volumes brought. Individual companies are responsible for their own reporting. DMI has requested that each conifer operator report their volumes to DMI for tracking purposes.

11.1 Salvage

Salvage volumes that are utilized by mills will be reported with weigh scale information and charged against that companies AAC. For known unsalvaged volume that is destroyed by other landuses, volume estimates will be made based on the area cleared and the provincial Timber Damage tables and reported proportionally against all of the affected company allocations on the FMA. No dues are charged to the companies by Alberta for salvage.

11.2 Crossings

Temporary crossings typically use log fills consisting of 15 deciduous trees with a volume of 0.25 m3/tree on average. This average volume of 3.75 m3/crossing is used to together with the number of temporary crossings to determine the total volume destroyed
Summary tables of all forms of production will be included annually in the GDP.

11.3 Retention

Retention will be measured annually and where merchantable volume is left, it will be reported as production volume against the AAC. Where aerial photography is utilized for the determination of retention volumes, actual volumes will be delayed by at least one year due to the time required to obtain the photos and complete their interpretation. In this situation, companies may provide estimates of retention within blocks in lieu of actual numbers and make the necessary adjustments to the volumes the following year. No dues will be charged for retention.
Each company is responsible for measuring and reporting of retention.

11.4 Deciduous Chipper Gain

Deciduous volumes, originating from portable chipper sites, will have a suitable adjustment factor applied to accurately account for non-merchantable fibre contained within the scaled volume.

Based on the chipper gain study completed by DMI for ASRD, a rigorous process is used to determine the percent reduction in deciduous volume to reduce what is reported against DMI's deciduous AAC. DMI and ASRD review the factor calculations annually.

11.5 Core/Contingency

The Spatial Harvest Sequence (SHS) is categorized into core blocks and contingency blocks. All operators will be provided separate Annual Allowable Cuts (AACs) for core and contingency volume for their dispositions. In keeping with reporting of production to TPRS, the GDP and the stewardship report will be for each disposition's core and contingency AAC.

12: Silviculture

12.1 Regeneration Standards of Alberta (RSA)

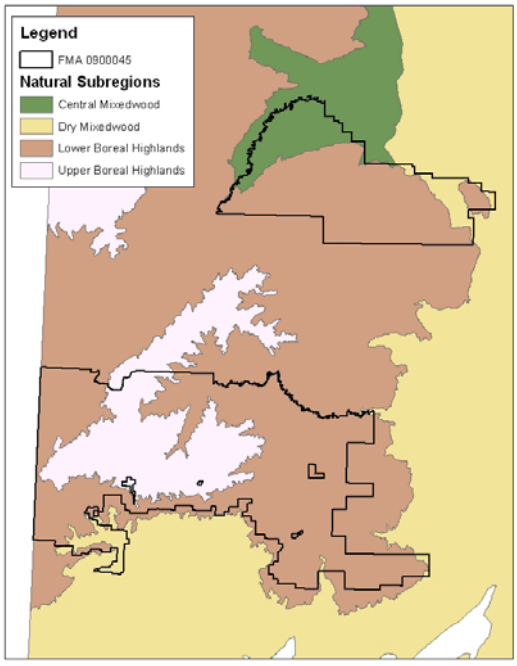
Detailed explanation of DMI commitment to RSA is provided under separate cover.
Reforestation Strategies

The main functions of the Reforestation Strategy are to reforest the harvested blocks as consistent with the assumptions in the Timber Supply Analysis (TSA) of the DFMP. It is imperative that all legislated requirements of the Forests Act, the Timber Management Regulations and the Forest Management Agreement are met

DMI's silviculture program focuses on supporting the regenerated yield assumptions in the TSA in a manner that will maintain the natural biodiversity and range of variability of the landscape. Silviculture activities are carried out foremost to ensure replacement of the productive forest; but they are delivered in a thoughtful manner so as to not only maintain forest productivity, but also to maintain species and genetic diversity, range of habitats, and soil and water quality. The silvicultural techniques that are utilized are those that best allow the forest to develop and transition along natural pathways.

12.2 Natural Sub-regions

Four Natural Sub-regions (Dry Mixedwood, Central Mixedwood, Lower Boreal Highlands and the Upper Boreal Highlands) make up the landscape contained within the FMA (see Map 18 or Section 4.1). Refer to the *Landscape Assessment Document* for a detailed description.



Map 18. Natural sub-regions on the west FMA.

12.3 Species of Trees Approved for Reforestation

Species included in the TSA and therefore approved for reforestation include:

Deciduous

- Aspen (Populus tremuloides)
- Poplar (P. balsamifera)

Coniferous

- White Spruce (Picea glauca)
- Black Spruce (P. mariana)

- Lodgepole Pine (Pinus contorta var latifolia)
- Tamarack (Larix laricina)
- Fir (Abies balsamea)

Table 28. Approved tree species by pathway.

Approved Tree Species by Pathway		
Species	Main Pathway	Secondary Pathway
Aspen	1, 2, 3, 4, 5	8, 9, 11
Poplar	8, 9, 11	1, 2, 3, 4, 5
White Spruce	2, 3, 4, 5, 6, 10,	0, 9, 12
Black Spruce	8, 9, 12	
Lodgepole Pine	7, 8, 9	
Tamarack	8, 9, 12	
Fir		

12.4 Reforestation Transitions in the TSA

The timber supply analysis assumes that natural stands will regenerate to their pre-harvest pathway. The modeling is very simple in that the model is not used to decide reforestation treatments. The TSA assumes that the forest will experience 'replacement' and maintain natural productivity and stand types into the future. The assumption is that the manager will do whatever is required to achieve the assumed response. The transition is not meant to be a prescription at the stand level – it is intended to represent a distribution across the landscape over the rotation.

12.4.1 Recent Cutover Transitions

Existing cutovers must be modeled on the ARIS record declarations. Table 29 explains the transitions used in the TSA:

Table 29. Cutover Pathway Transition in the Timber Supply Analysis.

ARIS Declared REGEN Code	Assigned Pathway Number	Assigned Pathway Label
C-2000	6	White spruce >> White spruce
CD-2000	4	Aspen >> Early Mixedwood >> White spruce
DC-2000	3	Aspen >> Late Mixedwood >> White spruce
D-2000	1	Aspen >> Shrub
CONIFER	3	Aspen >> Late Mixedwood >> White spruce
CONF	3	Aspen >> Late Mixedwood >> White spruce

12.4.2 Contributing Tree Species

When constructing yield curves, sample stands are selected based on stand level merchantability criteria. Once a stand is deemed 'merchantable', then all trees within the sample that meet minimum utilization standards contribute to either hardwood or softwood volume. Thus all tree species will inevitably contribute at some level to the final yields used in the TSA.

12.4.3 Successional Yield Curves

The yield curve strata are referred to as Pathways because the curves are representing a successional shift over time. The curves contain 7 successional pathways that represent the natural range of variation of stand structure observed in the aspen-white spruce system. The pathways attempt to show the transition from aspen dominated condition to spruce dominated conditions over the lifespan of the stands represented.

The document *Growth and Yield Information Package 2011* describes the yield curve stratification process. A summary is provided here for reference purposes.

Table 30 lists the Yield Strata (pathway) that form the stratification to model growth and yield. Yield Strata '0' represents non-forested stands. Yield Strata '13' represents black spruce stands that will be part of the inactive landbase.

In the table below, AVI tree species abbreviations were used in the description.

Table 30. LIST OF YIELD STRATA AND ASSOCIATED DESCRIPTIONS THAT DEFINED THE LANDBASE STRATIFICATION

(1) STRATA	(2) STRATA LABEL	(3) MODEL TYPE	(4) GENERAL DESCRIPTION
0	Non Forested	N.F.	No Trees in the overstory or understory

(1) STRATA	(2) STRATA LABEL	(3) MODEL TYPE	(4) GENERAL DESCRIPTION
1	Aspen >> Shrub	SUCC.	Aw dominated stands that succeed to open Aw and/or closed shrub stands
2	Aspen >> White spruce	SUCC.	Aw dominated stands that succeed late to open Sw stands with no overstory mixedwood phase in between.
3	Aspen >> Late Mixedwood >> White spruce	SUCC.	Aw dominated stands that succeed to Sw dominated stands with a late and well defined overstory mixedwood phase in between.
4	Aspen >> Early Mixedwood >> White spruce	SUCC.	Aw dominated stands that succeed to Sw dominated stands with an early and well defined overstory mixedwood phase in between.
5	Mixedwood >> White spruce	SUCC.	Aw leading mixedwood stands that succeed early to Sw dominated stands.
6	White spruce >> White spruce	SUCC.	Sw leading or Sw dominated stands that succeed to or remain Sw dominated stands over time. This stand type represents the eventual convergent pathway for Pathways 3, 4 and 5.
7	Pine	STAT.	At least 80% Pl composition in the stand.
8	Pine-Black spruce-Deciduous	STAT.	Pl or Sb leading with at least 20% deciduous component.
9	Deciduous-Pine-Black spruce	STAT.	Deciduous leading with at least 20% Pl and/or Sb component.
10	Pine-White spruce	STAT.	At least 20% Pl with at least 20% Sw
11	Balsam Poplar >> Shrub	SUCC.	Pb dominated stand that succeeds to an open Pb and/or closed shrub stand
12	Black spruce-Pine-White spruce	STAT.	At least 20% Sb with at least 20% Pl or at least 20% Sb with at least 20% Sw
13	Black spruce	STAT.	At least 80% Sb + Lt component

Aw-Aspen; Bw-White birch; Pb-Balsam poplar; Pl-Lodgepole pine; Pj-Jack pine; Lt-Larch; Sb-Black spruce; Sw-White spruce; Fb-Balsam fir. Model Types are: N.F. -Non Forested; SUCC-Succession based Yield Strata; STAT- Static based Yield Strata

12.5 Seed Zones and Reforestation Seed Supply

Seed zones within the FMA include LBH1.3, LBH1.4, UBH1.2, CM1.2, CM2.3, CM3.3, DM1.1, DM1.2, and DM1.3.

Table 31. Seed zones on the FMA.

Seed Zone	Seed Zone Area (ha)	Conifer Seed Supply (kg)
CM 1.2	4,123	0.000
CM 1.3	58,436	0.000
CM 2.3	386,430	15.989
CM 3.3	140,343	0.000
DM 1.1	206,970	0.000
DM 1.2	444,786	33.857
DM 1.3	15,123	0.000
LBH 1.3	1,261	0.000
LBH 1.4	449,757	0.000
LBH 1.6	656,362	19.068
UBH 1.2	107,192	0.000
UBH 1.3	198,200	0.000

Forest within DMI's FMA and specific seed zones depicted in red were not harvested historically or had very little harvesting activity. Therefore, obtaining seed for these seed zones was not a priority. To account for this deficiency in seed supply, DMI has compiled seed inventory from several companies willing to sell or trade seed from their inventory. Through this method DMI is able to acquire seed that is not normally required. Seed Zone CM 3.3 was not acquired because an agreement between DMI and Buchanan exists and states that Buchanan is responsible for reforestation responsibility in the area that occupies most of DMI's CM 3.3 seed zone FMA area.

Through the seven year historical seed zone harvest some high priority seed supply deficiencies were identified. In the 2011 season a seed collection is planned and outlined below. DMI has attempted seed collections in 2009 and 2010 but was not successful due to poor seed crops and insect degradation of seed crop.

Table 2:

Table 32. DMI seed collection in 2011.

Seed Zone	Species	Conifer Seed Amount (kg)
CM 1.3	Sw	5
DM 1.1	Sw	10
DM 1.2	Aw	
LBH 1.4	Sw, Aw	10
LBH 1.6	PL, Aw	10

All forest companies are required to maintain an adequate seed supply for each species in each seed zone in which they operate where artificial regeneration using seedlings is planned. Seed is collected according to the guidelines of the Alberta Forest Genetic Resource Management and Conservation Standards, Alberta sustainable Resource Development, 2009; and is stored at the Alberta Tree Improvement and Seed Center (ATISC) in Smoky Lake, Alberta. Companies report annually, in their Reforestation Program, the quantity of seed in inventory at ATISC, and their intent to collect.

12.5.1 Quota Holder Seed Supply

The coniferous component of conifer and mixed wood blocks are usually reforested using artificial regeneration with seedlings. An adequate supply of white spruce and lodgepole pine seed to meet the projected planting requirements for 10 years is collected and stored at ATISC. All seed collections are from unselected parents in unselected stands (Genetic Class Code AIa1). There is no intent to deploy improved stock on the DMI FMA.

12.5.2 DMI Seed Supply

As a deciduous operator relying to a large extent on natural regeneration, seed requirements are far less than that of the conifer quota holders. Seed inventory includes both deciduous and coniferous seed for approved reforestation species. All seed collections are from unselected parents in unselected stands (Genetic Class Code AIa1). There is no intent to deploy improved stock on the FMA.

12.5.3 Secondary Timber Species (Incidental) Utilization and Replacement

The allocation and replacement of incidental timber arising out of the pure stand types is determined in subsequent agreements with the quota holders. The required stocking to

replace the conifer incidental is directly related to the volume of incidental conifer timber utilized, and is tracked through silviculture surveys and the planting records in the silviculture database. All incidental deciduous is directed to DMI. Replacement occurs naturally though suckering. Assurance that incidental deciduous remains subsequent to conifer stand tending activities is gained through a review of the stand tending proposals of the quota holders.

Incidental timber volume is included in the TSA. Primary and secondary volumes are tracked and controlled in the TSA and reported in the AAC allocations.

The successional yield curves model the fact that the aspen-white spruce system will change covertype if left alone. The periodic stand composition is modeled to change and the sustainable AACs have that built into the calculation. Individual stands will change covertype – the TSA accounts for that and still manages to maintain landscape targets of covertype.

12.6 Reforestation Process

Coniferous vs Deciduous Operations

Coniferous and deciduous silviculturists follow similar procedures in terms of considering and addressing reforestation issues. A key difference is that deciduous cut blocks will usually regenerate naturally by suckering with little to no silvicultural intervention; while the conifer dominated cut blocks frequently require artificial regeneration accompanied by site preparation and stand tending treatments. Quota holders therefore tend to site prep and plant the year following harvest. DMI tends to plant the second year after harvest focusing only on areas that are not regenerating naturally due to harvest disturbance or site limitations. The following sections outline general reforestation planning and treatment processes considered by the silviculture forester.

12.6.1 Pre-Harvest Reforestation Considerations

The reforestation process begins at the planning stage, with planners carefully reviewing the proposed cut block using current technology combined with field visits. Areas with a high potential of difficulty in reforestation are removed from the block. Layout contractors are instructed to further refine block boundaries and retention areas to protect:

- Sensitive areas such as vernal pools and water courses,
- Areas of importance to wildlife such as raptor nests and mineral licks, and
- Areas with potential reforestation problems not identified initially by the planners.

Planners provide the silviculture forester with information relative to reforestation such as soil type, potential for high grass competition, vigor of overstory, and understory potential. This provides the silviculture forester with the knowledge required to anticipate

site limitations and potential challenges to reforestation success, and plan for treatments.

As the block moves into the harvesting stage, the focus on reforestation continues. Guidelines for operations have been developed to minimize soil disturbance, compaction, and impacts of debris. There is a continual focus on how to adjust harvesting practices to further minimize negative impact on reforestation. As opportunities for improvements become apparent, operational procedures are modified.

12.6.2 Reforestation Timelines

Successful reforestation requires deploying any required treatments in a timely manner, from a physiological, operational, and legislative perspective. When planting is required, cutovers should be planted as soon as possible after harvest, and ideally the year following harvest, to allow the seedling to establish before the competing vegetation. Due to operational constraints, such as wood being left in the blocks or the need to access the blocks to burn debris piles, planting may occur two years after harvest. If an intervention treatment is required subsequent to establishment to control the competing vegetation, it should be timed to maximize impact on the competition and minimize impact on the crop tree. Legislated reforestation timelines are stated in the Timber Management Regulations, 2008, the Reforestation Standards of Alberta, 2011, and the Herbicide Reference Manual, 2004.

12.6.3 Post-Harvest Reforestation Considerations

The silviculture forester uses the information from the planners and operational foresters, and information gained through a field visit, to determine if there are challenges that may inhibit the natural reforestation success of the block. If the block requires no intervention, it will be monitored during the establishment phase to verify whether or not it is regenerating along the pathway as expected. If it is not, or if the cutover was deemed to require treatment immediately after harvest, treatments are prescribed and implemented to alleviate the factors most limiting to successful reforestation of the block. Components of the block reforestation strategy may include:

- The reforestation objective of the block, including composition and growth expectations, based on pre-harvest condition, DFMP landscape level assumptions, and TSA assumptions;
- A description of the factor or factors compromising regeneration;
- A description of the treatment or treatments to mitigate the factor(s);
- The species and number of planting stock required; and
- A description of future tending requirements.

Reforestation strategies and subsequent treatment decisions are based on determination of site characteristics that may negatively impact the establishment and growth of the regenerating stand, and knowledge of establishment and treatment options available to alleviate or mitigate the limiting site characteristics.

Site limitations can be categorized as:

- Biotic, including
  - Vegetative competition
  - Pre-harvest vigor and condition of aspen stand
  - Herbivory by rodents and ungulates
  - Herbivory by insects
  - Disease
  - Absence of viable propagules
- Abiotic, which may be related to site topography and topographic position and includes
  - Soil characteristics
    - Nutient poor
    - Low soil moisture, or drought
    - High soil moisture
    - Cold soils
    - Frost heaving
    - Frost pockets
    - Winter desiccation

During the planning, layout and harvest stages, considerations are given to strategies to minimize both the biotic and abiotic limitations through strategic placement of block boundary, retention and deletions, and avoidance of understory during harvest operations. Post-harvest, the silviculture forester has options available to address biotic and abiotic site limitations that may remain. Decisions will include the method and details of establishment, whether or not site preparation is required and if so what technique to use and the need for stand tending. These decisions will be based on a determination of inputs deemed necessary to achieve the natural regenerated yields as predicted in the TSA. A general description of options available is provided in the following sections.

12.6.4 Establishment Options

DMI is focused on regenerating the natural forest system, so establishment options focus firstly on natural regeneration. Artificial regeneration is employed where species composition or site factors limit natural regeneration. Choice of establishment options should complement choice of site preparation treatment. Together they should focus on mitigating the site factors limiting to the establishment phase.

12.6.4.1 Natural Regeneration

Leave for Natural (LFN) – Coppice Growth for Deciduous

DMI's main fiber source is the deciduous forest, consisting of mainly aspen (Populus tremuloides) and balsam poplar (P. balsamifera). Aspen and poplar have evolved to quickly capture a site by vegetative propagation after a major disturbance such as fire or timber harvesting. The removal or death of the mature stem creates a hormonal condition that initiates the growth of suckers from the adventitious buds located on the extensive and mainly shallow root system. Aspen is well known for its suckering ability; poplar also suckers, but is more inclined to coppice from the stump. Both species will capture the site with 100,000 stems per hectare or more. The density of stems reduces naturally over time. This natural self-thinning occurs though out the natural life span of the stand and results in healthy, viable mature deciduous stands. Self thinning is the result of intra-specific competition, which can be exacerbated through environmental stressors such as herbivory by ungulates, rodents and insects, and disease such as Shepherd's Crook and root rot.

For suckering to be a successful means of reforestation the following should be considered:

1. The density of suckers the year after harvest should be at least 5,000 stems per hectare and preferably more. The huge root system of the mature tree requires nutrients in order to remain healthy and viable; these nutrients are supplied through the photosynthetic activity of the leaves of the suckers. The greater the leaf area is, the healthier the mature root and the more rapid the growth of the suckers.

2. The mature stand prior to harvest should contain healthy, vigorous trees which would be indicative of healthy root systems. Decadent and over mature stands may sucker back vigorously, but there is a greater chance of poor suckering than with an initially healthy stand.

3. Compacted soils inhibit suckering. Soils are prone to compaction when they are non-frozen, fine textured and moist.

4. Debris loading greater than 5 centimeters inhibits suckering by creating a barrier to the emerging sucker.

5. Aspen suckering requires warm soils. Debris loading reduces soil temperature; reduced soil temperature reduces suckering vigor.

12.6.4.2 LFN – Coniferous

Coniferous LFN may be a valid natural establishment option under the following situations:

1. The harvested stand consisted of a significant amount of pine. Similar to aspen, lodgepole pine has evolved to quickly capture a site after a fire, but unlike aspen, pine relies on the serotinous cones that open up from the heat of the fire and release the seed. By using appropriate site preparation methods to spread the cones and warm the soils, this characteristic of pine can be successfully be used to reforest cutovers.

2. The harvested stand contains mature deciduous in the overstory and non

merchantable white spruce in the understory. If harvest techniques are utilized to leave the white spruce understory standing after harvest, and protect it from wind throw, the understory (advanced growth) will contribute to the conifer stocking in the cutover, and provide a significant boost to conifer productivity over planted seedlings. This natural regeneration method may need to be supplemented by artificial regeneration such as planting.

3. Mature spruce, which will be a seed source, remain standing in close proximity to the harvested block. The process of harvesting often creates enough ground disturbance to expose mineral soil and therefore produce suitable areas for germination and growth of conifer seed. If there are spruce seed sources present, either adjacent to the cutover, or in retention patches inside the cutover, natural seeding will result in ingress. This natural regeneration method will result in an initial lower productivity than planting, and may need to be supplemented by planting depending on stocking and productivity goals.

12.6.4.3 Artificial Regeneration

12.6.4.3.1 Seeding

The artificial dispersal of seed may be a reasonable option for the establishment phase if preceded with suitable site preparation and yield projections are within the objectives of the DFMP.

12.6.4.3.2 Planting

Planting is currently the most common and effective means of artificially regenerating a stand. Species options include all forest tree species and a range of stock types, seedling size, and seedling condition; thus providing an opportunity to order a species with stock type and seedling characteristics best suited to overcome the site limitation in conjunction with the site preparation technique. Planting can occur in the spring with over-wintered dormant seedlings, or during the summer with seedlings that have been initiated to set bud prior to lifting, and are planted immediately after the lift. For conifer, during drought conditions, a summer plant may be preferable because the bud of the seedling will not flush until the following spring reducing the amount of moisture required for survival. There are advantages and disadvantages for both spring and summer stock. Choices are made based on site and stock information, as well as operational feasibility. Aspen can set bud and re-flush several times over the growing season, therefore is best planted in the spring as overwintered dormant stock to provide opportunity for root growth prior to leaf flush.

The selected planting density will be reflective of the desired stocking at maturity, anticipated establishment mortality and accumulative mortality from establishment to maturity. In determining planting density consideration is given to the projected productivity in the DFMP as well as site and environmental factors, and planned interventions, which will impact seedling survival, growth and yield. Site and environmental factors to consider that create limitations to crop establishment, and

ultimately final yield, may include:

- Soil aeration and compaction;
- Soil nutrients;
- Soil moisture;
- Soil temperature;
- Debris loading;
- Winter desiccation;
- Frost pockets;
- Vegetation competition – severity and type; and
- Herbivory.

Interventions either prior to planting (site preparation treatments) or post planting (stand tending) can aid in alleviating or mitigating the above limitations. Some possible interventions are described in the following sections.

12.6.4.4 Site Preparation Treatments

12.6.4.4.1 Chemical

The two herbicides most commonly used for site preparation are glyphosate and imazapyr. Glyphosate can be used to reduce vegetation competition for one year by treating the area prior to planting, and then planting the seedling into the treated area two or three weeks after treating, or the following spring. This approach can be used for deciduous planting as well as conifer. Imazapyr is persistent and will control grass and broadleaf competition for several years, but can be used for conifer planting only and not deciduous. The most common use of both these herbicides is to control grass, specifically Calamagrosis canadensis or reedgrass. Because of its rapid spread by rhizomes, the only effective control is a translocating herbicide that is able to penetrate and kill the root system. They are also used effectively to control aspen and shrubs when planting conifer.

12.6.4.4.2 Debris Management

When debris is greater that about 5 centimeters thick, it creates a barrier to aspen suckering, and prevents soil warming. It therefore has negative impacts on both aspen suckering as well as planted conifer seedlings. As part of the harvest process, the debris around landings and chipper sites is pushed up into piles and burned, but occasionally enough debris remains on the ground to compromise suckering or seedling survival and growth. When this occurs, a silviculture treatment to reduce debris depth and expose mineral soil (therefore increase soil temperature) may include a mechanical site prep such as dragging or scalping, or instructions to the planters to foot screef when planting.

12.6.4.4.3 Soil Decompaction

Soil compaction results from heavy equipment travelling on soils that are fine textured, non-frozen and moist. The weight and vibration of the equipment destroys soil structure by decreasing porosity, hence increasing bulk density. This creates a serious

impediment to regeneration as neither roots not water can easily penetrate compacted soils. Restoring soil structure is a difficult challenge, as soil porosity must be regained through natural freeze-thaw processes. Specially designed deep tillage equipment is used to lift and shatter the compacted layer, allowing water to penetrate and the natural freeze-thaw cycle to restore porosity.

12.6.4.4.4 Scalping

The intent of scalping is to remove the duff from the forest floor to increase soil temperature which in turn will increase suckering response of aspen, survival and growth of planted seedlings, and seed beds for natural or artificial seeding. Scalping should not remove the nutrient-rich “A” soil horizon which also contains the majority of the aspen roots that are the source of the aspen suckers. When planting, small ‘scalps’ can be achieved by foot screefing.

12.6.4.4.5 Dragging

The use of heavy drags serves several purposes. As with scalping, it removes the duff from portions of the forest floor, and re-aligns debris causing increases in soil temperature to stimulate aspen suckering. It creates plantable spots for seedling establishment and microsites for natural or artificial seedling. Dragging in pine blocks will distribute the cones across the site and the warmer soils will aid in releasing the seed from the resinous cones. The duff and debris that is re-aligned, but reasonably well distributed across the site, will provide nutrients to the soil over time.

12.6.4.4.6 Mixing (Small Elevated Microsites)

The main purpose of mixing is to create soil conditions suitable for planting and is commonly used by the conifer quota holders. Mixing can be achieved with a variety of techniques and equipment, the more common being the ripper plough and the shark-fin barrels. The surface humus layers are mixed with mineral soil creating small elevated microsites. The result is enhanced soil temperature, aeration, nutrition and moisture status. A variety of planting microsites can be created using mixing treatments, allowing planting locations to be selected to maximize the effectiveness of the treatment, particularly s pertains to soil moisture. On a drought prone site, the seedling would be planted in the lower position or scalp where moisture would tend to accumulate; on imperfectly drained sites, the higher position would be chosen to elevate the seedling above the wet soils; and on mesic sites the mid-position would normally be chosen as the planting spot.

12.6.4.4.7 Large Raised or Inverted Microsites

The larger raised microsites or mounds can be used to alleviate several site limitations. Because of the elevated soil cap, they are effective in addressing situations of poor soil drainage or potential flooding. A scoop of soil is flipped up and inverted over the undisturbed soil. This increases soil temperature and relocates organic and mineral soil nutrients to the location of the seedling thus providing the seedling with a head start over the competition. Raised microsites can be created using a mounding bucket on an

excavator which makes one mound at a time and can therefore easily treat smaller areas within a block; or towed implements that can make a continuous mound (bedding plows), or rows of single mounds (mounders).

12.6.4.4.8 Prescribed Burn

A prescribed burn can be an effective method to control competing vegetation, but the risk of fire spread and public concern make it an unpopular treatment. It is therefore not included as an option in the Silviculture Strategy.

12.6.4.5 Other considerations

Some of the potential limitations to establishment such as winter desiccation, frost pockets, frost heaving, disease and herbivory (insect, rodent and ungulate) cannot be alleviated solely by site preparation techniques. However, by understanding the science behind each and relating that knowledge to the site topography and design, their impact can be reduced through innovative options, for example choice of species, use of species mix, placement of seedling during planting, leaving of retention to break air currents, placement of alternative food choices (for rodents), and application of artificial fertilizer.

12.6.4.6 Stand Tending

After the regenerating stand has been established, there may be a need for further treatment to maintain the desired productivity of the stand. In conifer or mixed wood stands, conifer growth may be compromised by vegetation competition, usually in the form of competing shrub and aspen, or grass. If aspen is the main competitor, the conifer may be “released” from the aspen competition by removing aspen stems from around the conifer trees using ground treatments (herbicide or manual) or aerial herbicide. If shrubs and/or grass are the main competitors, the preferred cost-effective treatment is aerial herbicide. This type of treatment will increase conifer productivity at the expense of the deciduous therefore may be used to adjust stand composition to maintain the stand on its projected trajectory.

If stand productivity is reduced due to poor stocking, a fill-in plant may occur. The choice of seedling and site preparation will depend on the cause of the poor stocking, as per the previous Sections on Establishment Options and Site Preparation Treatments, and the desired stand composition.

12.6.4.7 Monitoring and Record keeping

All reforestation treatments and relevant block information are tracked in a company database, and required information submitted to the government database, ARIS, as per the legislated timelines. All blocks are surveyed according to the requirements of the Regeneration Standards of Alberta (RSA) – establishment surveys, years 4-8 and performance surveys, years 12-14. In addition, companies continually monitor regenerating cut blocks to identify regeneration issues and determine success of prescribed treatments. Both the RSA surveys and the non-legislated monitoring are used to determine the need for follow up reforestation treatments and pathway re-

assignment.

12.6.5 Understory Management

12.6.5.1 Purpose of Understory Protection

Understory management is practiced in all stand types containing suitable white spruce understory, and balsam fir where approved by Alberta. Suitability of understory for management is largely dependent on height and stocking, and is detailed in the Partial Harvest (Non-clearcut) Planning and Monitoring Guidelines, 2006. The main objective of managing for coniferous understory is to enable the advanced conifer growth to contribute to future forest values. Successful understory management, in conjunction with conifer ingress, may assist in incidental conifer replacement and the creation of DC stands as part of the successional pathway.It also maintains ongoing cover for wildlife.

“Protection of sub-merchantable understory trees during harvesting operation can provide for multiple benefits including increased fiber availability through capture of higher merchantable conifer volumes or reduced effective rotation age; reduced silviculture costs through the trading of preserved understory for reforestation responsibilities in other areas; and enhancement of non-fiber value objectives through increase retention of structural diversity (species and size classes) or through increased aesthetic value of areas harvested with understory protection strategies.” (excerpt from

Partial Harvest (Non-clearcut) Planning and Monitoring Guidelines, 2006)

12.6.5.2 Methods of Understory Protection

Two understory management techniques are used:

- Avoidance is utilized when the understory is clumpy and aggregated, usually in stands with a low density of understory. The clumps of conifer understory are protected from wind throw by leaving merchantable deciduous overstory around the clump.
- Protection, or trailing, is used when the understory is more evenly distributed, usually in areas of moderate to high density of understory. Preplanned skid trails are used, and deciduous adjacent to the trails removed by reaching in with the feller buncher. Some merchantable deciduous are left standing with the conifer understory to protect the understory from wind throw.

Post-harvest assessments are completed to assess the success of the understory protection plan and harvesting technique. This information provides an opportunity to improve the understory management process as well as aiding in the reforestation planning process.

12.6.5.3 Stand Selection Criteria

The following factors are considered prior to the development of an understory

management harvest plan:

- Land base assignment from the DFMP
- Characteristics of the understory, mainly species, spatial distribution, density and height, health and vigor, size and wind permeability of the crown, and height-diameter ratio (slenderness coefficient).
- Site conditions, such as soil conditions that may limit rooting and hence wind-firmness; topographic features that may enhance or diminish wind-firmness; adjacent stand features; and impacts on understory wind firmness.

Understory discovered in the field during harvest, but not previously identified during the planning process is protected.

12.6.6 Enhanced Forest Management Strategies

No enhanced forest management strategies will be applied to the developing stand. The intent is to bring stands back onto natural yield curves at pre-harvest productivity levels.

12.6.7 The Reforestation Strategy Table Background

12.6.7.1 Introduction

During the process to model growth and yield for the Forest Management Area (FMA), the forested land base was stratified into 13 different stand types called “pathways”. Each pathway has a unique regenerated yield trajectory approved and incorporated in the timber supply analysis (TSA).

12.6.7.2 Link to Operational Reforestation Planning and Delivery

The information in the Reforestation Strategy Table describes the commitment and justification for meeting the following reforestation objectives:

1. The establishment of a productive forest on the harvested area that maintains the natural biodiversity and range of variability of the landscape;
2. Creation of the TSA regenerated forest structure by species, proportion, density and distribution;
3. Meeting the pathway productivity targets in the regenerated yield projection of the TSA.

The Reforestation Strategy Table provides a brief description of each pathway in addition to a range of reforestation strategies that are designed to achieve the reforestation objectives embedded in the calculation of a sustainable cut level for the FMA, i.e. to permit each pathway to achieve, or surpass, the productivity of its regenerated yield trajectory. The strategies described are linked to expected

achievements in stand structure and productivity while considering the effects of site and climatic variables on survival and growth of the regenerating forest. Although the reforestation strategies proposed may achieve the desired reforestation objectives most of the time, there may be occasions when alternative treatments are required or desired. The employment of alternate strategies requires approval from Alberta, normally achieved through approval of the annual Reforestation Program. The Reforestation Strategy Table is part of a silviculture decision system. It is not prescriptive, nor is it intended to limit treatment options.

12.6.7.3 Roads, Landings and Processing Areas

The roads, landings and processing areas of cutblocks are treated as a separate entity in the Table. They do not represent a separate pathway; rather it is assumed that they will regenerate to the same pathway as the adjacent stand. They have been placed in a separate category because they are more intensely disturbed than the remaining stand and may therefore require different treatments in order to obtain the same reforestation objective.

12.6.7.4 Content of the Reforestation Strategy Table

The contents of the Reforestation Strategy Table include the following 12 columns:

1. Reference Number for the DFMP Pathway
2. The Regenerated Yield Trajectory
3. Description of Pathway as Defined in the DFMP
4. Broad Cover Group by Volume (reference age)
5. Transitions Towards Climax
6. Species Proportions by Volume
7. Limitations to Crop establishment
8. Silviculture System
9. Site Preparation
10. Establishment Options
11. Stem Density Options at Establishment Phase
12. Reforestation Stage Intervention

Below is a detailed description of each column:

1. Reference Number for DFMP Pathway

An arbitrary number assigned to the Pathway for ease of reference and discussion.

2. The Regenerated Yield Trajectory

The name of the Pathway that forms the land base stratification used to model growth and yield within the DFMP. The symbol >> indicates a successional pathway and states the future stand composition should no disturbance intervention, such as harvesting, occur. Non-successional, or static, pathways are indicated by a dash (-) between species, indicating potential compositions of the current harvestable or harvested stand. Pathways 1, 2, 3, 4, 5, 6, and 11 are successional pathways; while 7, 8, 9, 10, 12, and 13 are static.

3. Description of Pathway as Defined in the DFMP

A brief description of the successional development and/or composition of the forest stands that fall within the Pathway.

4. Broad Cover Group by Volume (reference age)

The broad cover group (BCG) assigned to each Pathway based on merchantable coniferous and deciduous volumes, specifically: C (pure conifer), CD (conifer leading mixed wood), DC (deciduous leading mixed wood) or D (pure deciduous). The bracketed number following the BCG designation refers to the age at which the stand would be defined by the designated BCG.

5. Transitions Towards Climax

This states whether the composition, structure and yield of the regenerating stand is intended to deviate, or transition, from the original as it moves toward the reforestation objective. At a landscape level, the intent is to replace back on the land base stands with yields and structures similar to that which was harvested. This will be achieved by applying appropriate treatments to each block after harvest to place it back on the original pathway. Exceptions to this at a block level may occur from time to time depending on strata balancing requirements, and site or environmental limitations. At the landscape level, however, transitions are not intended to occur.

6. Species Proportions by Volume

This column describes the intended final yield and structure of the forest stand, based on AVI percent merchantable volume required to achieve the target of ‘no transitions’ outlined in the previous column. Tree species are stated only in general terms of deciduous or coniferous. When understory protection is an option for the silviculture system, advanced stocking is described, and will provide for a greater mean annual increment than planted seedlings. The 15% on average representative retention left in each block at the time of harvest operations will provide ecological benefits during stand development, and is not intended to contribute to the stand volume.

7. Limitations to Crop establishment

This information is the basis for site specific treatments included in subsequent columns of the Table, and includes climatic, site and biological limitations. This information is based on site assessments, expert knowledge and the Alberta Silviculture Guide: Boreal Mixedwood and Lower Foothills Natural Subregions. Version1.

8. Silviculture System

The silviculture system refers to the harvest system selected to obtain the desired post-harvest stand structure that will best meet the pathway objective. In all pathways, historically the silviculture system has been “clear cut with 0% - 30% retention” as it accommodates aspen suckering, pine natural seedling, as well as treatments required for conifer planting. This will continue to be the chosen silviculture system implemented, with the use of understory protection and/or avoidance in blocks where the quantity and distribution of understory structure warrants.

9. Site Preparation

The operational strategies selected to promote establishment and growth of the regenerating stand for the purpose of achieving the stated silviculture objectives are described here. Acceptable strategies include no site prep, mechanical site prep and chemical site prep. The choice of site preparation activities is dependent on the site limitations, establishment options, and the need for pre-establishment vegetation control.

10. Establishment Options

Establishment options describe the operational strategies for establishing the desired tree species in the block as per the previously described ‘Species Proportions’. A variety of options exist for natural regeneration including leave for natural (LFN) – coppice for deciduous, LFN – advance stocking for understory conifer, and LFN – seed for pine. Artificial regeneration focuses mainly on planting, although artificial seeding of some species such as pine may be a valid option.

11. Stem Density Options at Establishment Phase

The final reforestation objective for each pathway is defined in terms of yield. To achieve this stated objective at maturity, a density of propagules is required during the reforestation phase, specifically year 12 – 14 when block productivity (measured as mean annual increment – m3/ha/yr) and structure are measured as per the Reforestation Standards of Alberta (RSA, May 2010). Stem density options provided in the Table provide a guide only for initial establishment. Final prescriptions could vary from the Table depending on expected mortality and growth rate. Additional subsequent planting may be required to meet the productivity targets of RSA. All stem density options are based on an even distribution of propagules across the opening.

12. Reforestation Stage Intervention

A reforestation stage intervention is an activity that may be required to maintain the stand development on the desired pathway trajectory, and will typically be determined subsequent to an assessment. Options may include stand tending or fill-in planting.

12.7 References:

Choosing and Justifying the Reforestation Strategy in the Detailed Forest Management

Plan, ASRD

Reforestation Standard of Alberta, 2010; ASRD

Silvics of North America Volumes 1 Conifers and 2 Hardwoods; USDA Agriculture Handbook 654; 1990

Alberta Silviculture Guide: Boreal Mixedwood and Lower Foothills Natural Subregions. Version 1, 2007; Geographic Dynamics Corp and Incremental Technologies Ltd; developed for Mixedwood Management Association

Regenerating British Columbia's Forests, 1995; Editors Lavender, Parish, Johnson, Montgomery, Vyse, Willis, Winston; UBC Press

12.8 Silviculture Matrix Table

1	2	3	4	5	6	7	8	9	10	11	12
Reference Number for DFMP Pathwa	Regenerated Yield Trajectory	Description of Pathway as defined in the DFMP	Broad Cover Group by Volume (reference age)	Transitions Toward Clima	Species Proportions by Volume	Limitations to Crop Establishment	Silviculture System	Site Preparation	Establishment Optio	Stem Density Options at Establishment Phase	Reforestation Stage Intervention
0	Non Forested	No Trees in the overstory or understory	n/a								
1	**aspen >> shrub**	Deciduous dominated stands that succeed to open deciduous and/or closed shrub stands. In the absence of catastrophic disturbances most stands will succeed to shrub or open deciduous and shrub by about 200 years. Pathway 1 is the same as Pathway 11 except that aspen, rather than balsam poplar, is the leading deciduous species.	D(90)	No transition anticipated. Stand structure remains pure deciduous; stand density remains the same as pre-harvest.	The stand will be stocked to ≥80% aspen with minimal incidental conifer	Limitations to crop establishment may include: cold, wet soils; vegetative competition (grass, mixed, woody); drought; herbivory; winter desiccation; harvest debris; modifcation of soil structure; deciduous root damage; insects and disease	Clearcut; may include retention	No site prep required; may wish to reduce debris depth and expose mineral soil	LFN, coppice growth	minimum acceptable deciduous 5,000 sph; maximum acceptable conifer is 400 sph	No intervention anticipated; may monitor prior to or at establishment survey phase and fill in plant deciduous or coniferous if required to meet reforestation goal
2	**aspen >> white spruce**	Deciduous dominated stands that, in the absence of catastrophic disturbances, succeed late to open conifer stands with no overstory mixedwood phase in between. Rather than reach the overstory, conifers become the overstory as a consequence of deciduous tree mortality. The most common stand types are aspen dominated overstories with suppressed white spruce understories.	D(90)	No transition anticipated. Stand structure remains pure deciduous with a conifer understory; overstory density remains the same as pre-harvest.	The stand will be stocked to ≥80% aspen with some incidental conifer and conifer understory	Limitations to crop establishment may include: cold, wet soils; vegetative competition (grass, mixed, woody); drought; herbivory; winter desiccation; harvest debris; modifcation of soil structure; deciduous root damage; insects and disease	Clearcut; will include understory protection and/or avoidance to maintain conifer understory if suitable understory present. May include retention.	No site prep required; may wish to reduce debris depth and expose mineral soil	LFN, coppice growth; if conifer understory protection/avoidance silviculture system, may also use LFN, advance stocking.	minimum acceptable deciduous 5,000 sph; maximum acceptable conifer is 400 sph	No intervention anticipated; may monitor prior to or at establishment survey phase and fill in plant deciduous or coniferous if required to meet reforestation goal
3	**aspen >> late mixed >> white spruce**	Deciduous dominated stands that succeed to conifer dominated stands with a late and well defined overstory mixedwood phase in between.The most common stand types include aspen dominated overstories with suppressed to intermediate white spruce understories.	DC(90)	No transition anticipated. Stand will establish and grow as a deciduous leading mixed wood. Stand density remains the same as pre-harvest.	The stand will be stocked to ≥50% deciduous and ≤30% conifer. 'The conifer component may consist in whole or in part of the understory conifer that remains after harvest.	Limitations to crop establishment may include: cold, wet soils; vegetative competition (grass, mixed, woody); drought; herbivory; winter desiccation; harvest debris; modifcation of soil structure; deciduous root damage; insects and disease	Clearcut; will include understory protection and/or avoidance to maintain conifer understory if suitable understory present. May include retention.	Site prep may have negative impact on understory protection/avoidance areas. If planting or seeding is required, may choose no site prep, chemical site prep or mechanical site prep. Choice of mechanical treatment effect will depend on site characteristics and seedling establishment requirements, and may include mixing, scalping or raised bed.	LFN, coppice growth; LFN, advance stocking; plant conifer	minimum acceptable deciduous 800 sph; acceptable conifer 500-1000 sph	May monitor prior to or at establishment survey phase and fill in plant if required to meet reforestation goal. May stand tend conifer prior to performance survey to reduce vegetation competition if required to meet reforestation goal.
4	**aspen >> early mixed >> white spruce**	Deciduous dominated stands that succeed to conifer dominated stands with an early and well-defined overstory mixedwood phase in between. The most common stand types include aspen dominated overstories with intermediate white spruce understories; aspen to white spruce leading mixedwoods; and white spruce dominated stands.	CD(110)	No transition anticipated. Stand will establish and grow as a coniferous leading mixed wood. Stand density remains the same as pre-harvest.	The stand will be stocked to ≥50% conifer and ≤30% aspen. 'The conifer component may consist in whole or in part of the understory conifer that remains after harvest.	Limitations to crop establishment may include: cold, wet soils; vegetative competition (grass, mixed, woody); drought; herbivory; winter desiccation; harvest debris; modifcation of soil structure; deciduous root damage; insects and disease	Clearcut; will include understory protection and/or avoidance to maintain conifer understory if suitable understory present. May include retention.	Site prep may have negative impact on understory protection/avoidance areas. If planting or seeding is required, may choose no site prep, chemical site prep or mechanical site prep. Choice of mechanical treatment effect will depend on site characteristics and seedling establishment requirements, and may include mixing, scalping or raised bed.	LFN, coppice growth; LFN, advance stocking; Plant conifer	minimum acceptable deciduous 500 sph; minimum acceptable conifer 800 sph	May monitor prior to or at establishment survey phase and fill in plant if required to meet reforestation goal. May stand tend conifer to reduce vegetation competition if required to meet reforestation goal.

5	**aspen leading mixed wood >> white spruce**	These stands succeed early from a deciduous-leading mixedwood overstory, to a conifer-leading mixedwood overstory, and then to a conifer dominated overstory. This pathway converges with Pathway 6 after 150 years. The most common stand types include aspen to white spruce leading mixedwoods; and white spruce dominated or pure stands.	CD(110)	No transition anticipated. Stand will establish and grow as a coniferous leading mixed wood. Stand density remains the same as pre-harvest.	The stand will be stocked to ≥50% conifer and ≤30% aspen.	Limitations to crop establishment may include: cold, wet soils; vegetative competition (grass, mixed, woody); drought; herbivory; winter desiccation; harvest debris; modifcation of soil structure; deciduous root damage; insects and disease	Clearcut; may include retention.	If planting or seeding is required, may choose no site prep, chemical site prep or mechanical site prep. Choice of mechanical treatment effect will depend on site characteristics and seedling establishment requirements, and may include mixing, scalping or raised bed.	LFN, coppice growth; Plant conifer	minimum acceptable deciduous 500 sph; minimum acceptable conifer 800 sph	May monitor prior to or at establishment survey phase and fill in plant if required to meet reforestation goal. May stand tend conifer to reduce vegetation competition if required to meet reforestation goal.
6	**white spruce >> white spruce**	These stands succeed early to pure conifer stands from conifer leading or conifer dominated stands. The most common stand types are white spruce dominated stands. This stand type represents the eventual convergent pathway for Pathways 3, 4 and 5.	C(120)	No transition anticipated. Stand will establish and grow as a pure conifer stand. Stand density remains the same as pre-harvest.	The stand will be stocked to ≥80% conifer with minimal incidental deciduous.	Limitations to crop establishment may include: cold, wet soils; vegetative competition (grass, mixed, woody); drought; winter desiccation; harvest debris; modifcation of soil structure; insects and disease	Clearcut; may include retention	May choose no site prep, chemical site prep or mechanical site prep. Choice of mechanical treatment effect will depend on site characteristics and seedling establishment requirements, and may include mixing, scalping or raised bed.	Plant conifer	acceptable conifer 1100-1600 sph	May monitor prior to or at establishment survey phase and fill in plant if required to meet reforestation goal. May stand tend conifer to reduce vegetation competition if required to meet reforestation goal.
7	**pine**	Pathway 7 is a static based pathway. In this stand type, pine species are greater than, or equal to, 80% of the combined overstory and understory.	C(90)	No transition anticipated. Stand will establish and grow as a pure conifer stand. Stand density remains the same as pre-harvest.	The stand will be stocked to ≥80% conifer with minimal incidental deciduous.	Limitations to crop establishment may include: cold, wet soils; deep duff levels; vegetative competition (grass, mixed, woody); drought; winter desiccation; harvest debris; modifcation of soil structure; insects and disease; low nutrient levels	Clearcut; may include retention	Preferred treatment may be no site prep, or dragging to initiate seed spread and germination. May also choose chemical site prep or alternative mechanical site prep. Choice of mechanical treatment effect will depend on site characteristics and seedling establishment requirements, and may include mixing, scalping or raised bed.	LFN, seed bed and seed source; Artificial seed or plant if required	acceptable conifer 1000-1600 sph	No intervention anticipated as vegetation competition is usually not an issue on pine sites. May monitor prior to or at establishment survey phase and fill in plant if required to meet reforestation goal. May stand tend if required to meet reforestation goal.
8	**pine-black spruce-deciduous**	Pathway 8 is a static based pathway. The most common stand types in this pathway are pine mixed with aspen; or low density aspen overstories with moderate to high density pine, black spruce and/or larch understories.	CD(110)	No transition anticipated. Stand will establish and grow as a coniferous leading mixed wood. Stand density remains the same as pre-harvest.	The stand will be stocked to ≥50% conifer and ≤30% deciduous. 'The conifer component may consist in whole or in part of the understory conifer that remains after harvest.	Limitations to crop establishment may include: cold, wet soils; vegetative competition (grass, mixed, woody); drought; winter desiccation; harvest debris; modifcation of soil structure; insects and disease; low nutrient levels	Clearcut; may include understory protection and/or avoidance to maintain conifer understory if present. May include retention.	Preferred treatment may be no site prep, or dragging to initiate seed spread and germination. May also choose chemical site prep or alternative mechanical site prep. Choice of mechanical treatment effect will depend on site characteristics and seedling establishment requirements, and may include mixing, scalping or raised bed.	LFN, coppice growth; LFN, advance stocking; LFN, seed bed and seed source; Artificial seed or plant if required	minimum acceptable deciduous 500 sph; minimum acceptable conifer 800 sph	May monitor prior to or at establishment survey phase and fill in plant if required to meet reforestation goal. May stand tend conifer to reduce competition if required to meet reforestation goal.

9	**deciduous-pine-black spruce**	Pathway 9 is a static based pathway. The most common stand types in this pathway are aspen mixed with pine, or high density aspen overstories mixed with low to moderate density pine, black spruce and/or larch understories.	DC(90)	No transition anticipated. Stand will establish and grow as a deciduous leading mixed wood. Stand density remains the same as pre-harvest.	The stand will be stocked to ≥50% deciduous and ≤30% conifer. 'The conifer component may consist in whole or in part of the understory conifer that remains after harvest.	Limitations to crop establishment may include: cold, wet soils; vegetative competition (grass, mixed, woody); drought; winter desiccation; harvest debris; modifcation of soil structure; deciduous root damage; insects and disease; low nutrient levels	Clearcut; will include understory protection and/or avoidance to maintain conifer understory if suitable understory present. May include retention.	Preferred treatment may be no site prep. May also choose chemical site prep or mechanical site prep. Choice of mechanical treatment effect will depend on site characteristics and seedling establishment requirements, and may include mixing, scalping or raised bed.	LFN, coppice growth; LFN, advance stocking; LFN, seed bed and seed source; Artificial seed or plant if required	minimum acceptable deciduous 800 sph; acceptable conifer 500-1000 sph	May monitor prior to or at establishment survey phase and fill in plant if required to meet reforestation goal. May stand tend conifer to reduce competition if required to meet reforestation goal.
10	**pine-white spruce**	Pathway 10 is a static based pathway where pine and white spruce, with lesser amounts of fir, black spruce and/or larch, make up both the overstory and understory composition.	C(90)	No transition anticipated. Stand will establish and grow as a pure conifer stand. Stand density remains the same as pre-harvest.	The stand will be stocked to ≥80% conifer with minimal incidental deciduous.	Limitations to crop establishment may include: cold, wet soils; vegetative competition (grass, mixed, woody); drought; winter desiccation; harvest debris; modifcation of soil structure; insects and disease; low nutrient levels	Clearcut; may include retention	Preferred treatment may be no site prep. May also choose chemical site prep or mechanical site prep. Choice of mechanical treatment effect will depend on site characteristics and seedling establishment requirements, and may include mixing, scalping or raised bed.	LFN, coppice growth; LFN, advance stocking; LFN, seed bed and seed source; Artificial seed or plant if required	acceptable conifer 1000-1600 sph	No intervention anticipated as vegetation competition is usually not an issue on pine sites. May monitor prior to or at establishment survey phase and fill in plant if required to meet reforestation goal. May stand tend to reduce vegetation competition if required to meet reforestation goal.
11	**balsam poplar>>shrub**	These are deciduous dominant stands with balsam poplar as the leading species, that succeed to an open poplar and/or closed shrub stand. Pathway 11 is the same as pathway 1 except that balsam poplar, rather than aspen, is the leading tree species	D(90)	No transition anticipated. Stand structure remains pure deciduous; stand density remains the same as pre-harvest.	The stand will be stocked to ≥80% aspen with minimal incidental conifer	Limitations to crop establishment may include: cold, wet soils; vegetative competition (grass, mixed, woody); drought; herbivory; winter desiccation; harvest debris; modifcation of soil structure; deciduous root damage; insects and disease	Clearcut; may include retention	No site prep required; may wish to reduce debris depth and expose mineral soil	LFN, coppice growth	Minimum acceptable deciduous 5,000 sph	No intervention anticipated; may monitor prior to or at establishment survey phase and fill in plant if required to meet reforestation goal
12	**black spruce-pine/black spruce-white spruce**	Pathway 12 is a static pathway and is defined by two stand types: 1) black spruce-pine or 2) black spruce-white spruce. It is a 'C' coverstate with white spruce being the lesser of the conifer species, with potential leading species being pine and/or black spruce and/or larch.	C(120)	No transition anticipated. Stand will establish and grow as a pure conifer stand. Stand density remains the same as pre-harvest.	The stand will be stocked to ≥80% conifer with minimal incidental deciduous.	Limitations to crop establishment may include: cold, wet soils; vegetative competition (grass, mixed, woody); drought; winter desiccation; harvest debris; modifcation of soil structure; insects and disease; low nutrient levels	Clearcut; may include retention	May choose no site prep, chemical site prep or mechanical site prep. Choice of mechanical treatment effect will depend on site characteristics and seedling establishment requirements, and may include dragging, mixing, scalping or raised bed.	LFN, seed bed and seed source; Artificial seed or plant if required	acceptable conifer 1000-1600 sph	No intervention anticipated as vegetation competition is usually not an issue on pine sites. May monitor prior to or at establishment survey phase and fill in plant if required to meet reforestation goal. May stand tend to reduce vegetation competition if required to meet reforestation goal.

13	**black spruce**	At least 80% Sb + Lt component. These are typically low areas, bogs and fens not suitable for harvesting, and do not include upland black spruce or larch that are included in Pathways 8, 9 and 12.					Not Cut (part of the inactive land base and not modeled for yield)				
	Roads and landings	This is technically not a yield group and is not intended to be treated as such. It will regenerate to the same pathway as the adjacent stand unless indicated otherwise. Roads and landings have been placed in a separate category because they are more intensely disturbed that the remaining stand and may therefore have different limitations to crop establishment, and may require a different site prep.	Same as adjacent regener-ating stand unless indicated otherwise	Same as the adjacent regenerating stand unless indicated otherwise.	Same as the adjacent regenerating stand unless indicated otherwise.	Limitations to reforestation may result from equipment impact and may include: 1) damage to the natural soil structure through compaction, loss of aeration, soil displacement; 2) removal of root propagules required for successful vegetative reforestation; 3) excessive debris loading.	Clearcut, which may be followed by removal and subsequent roll-back of surface soils	Reclamation treatment is determined by assessment of soil condition at time of entry for harvest, and extent and type of damage. Mechanical treatment may include deep tillage, ripping, screefing,	Leave for natural, suckering for deciduous; planting with coniferous or deciduous species	800 - 1600 stems per hectare deciduous and/or coniferous species	No intervention anticipated beyond that required for the adjacent regenerating stand. Both coniferous and deciduous species, or a combination, may be acceptable.

***NOTE – <u>Reforestation Stage Intervention</u>**

CANFOR has developed a Vegetation Management Strategy (VMS) for coniferous openings (DC, CD, C declared stands) which describes various deployment techniques for stand tending options. Any stand tending program undertaken on CANFOR coniferous openings will follow the strategies as outlined in CANFOR's VMS.

13: Forest Operations

13.1 Harvest & Trucking

DMI operates contracted mechanized harvests in both summer and winter. Deciduous volume is primarily processed in-block with portable chippers. Field chipped volume is trucked with chip vans directly to the mill site.

A portion of the annual deciduous supply is trucked in tree-length log form to satellite yards. DMI will continue attempts to improve integrated operations with conifer operators to add efficiencies and minimize road requirements.

Detailed rules and operating guidelines for these operations are found in the Operating Ground Rules and discussed in GDP planning phases.

13.2 Hog Fuel

The in-block chipping operations produce large quantities of waste material originating from the delimbing and debarking operation of the portable chipping. This material is useful to fire pulp mill boilers for the production of green power. DMI will, at its discretion, select specific blocks for hog fuel processing. Hog processing is considered an active forest operation phase. The timing of road closures and reclamations may be altered to accommodate this phase of operations.

Specific details covering this topic are found in the operating ground rules.

13.3 Grazing

Grazing has little impact on operations in this FMA. The grazing dispositions with timber harvest restrictions were removed from the FMA when it was re-defined in 2009. There are several small grazing dispositions totaling about 250 ha requiring notification.

DMI will follow all applicable regulations concerning grazing operators.

Table 33. Grazing disposition within FMA 0900045.

FMA0900045 DFMP 2009 - 2018 Grazing Areas Within the FMA			
Disposition Number	**Disposition Type**	**Landbase**	**Treed Area Hectares**
FGL870018	FGL	Conifer	40.38
FGL870018	FGL	Deciduous	57.81
FGL870018	FGL	Other	86.16
FGL890001	FGL	Conifer	15.75
FGL890001	FGL	Deciduous	136.16
FGL890001	FGL	Other	150.22
Total Conifer			**56.13**
Total Deciduous			**193.97**
Total Other			**236.39**
Total all Landbase			**486.49**

13.4 Visual Quality Strategies

FMA0900045 is located in an area of relatively little relief. However, there some concerns possible. Since 1989, DMI has only had to specifically consider viewscapes on two annual operating plans (one in P10 and one in P2). At this time, DMI expects few (if any) concerns to be raised over viewscapes that the retention strategy and continuous reserve network framework will not handle. However, DMI is prepared and committed to adjust sequences and block design on an individual basis if the need arises. If this is necessary, detailed plans and results will be provided in the GDP.

14: Access Management

Access to the landbase is necessary for forest companies in order for them to operate and procure fibre for their mills. As a measure to minimize the effects of roads on other values and in keeping with the commitment for integrated land management, DMI and the Quota Holders (QHs) operating on the FMA focus on the utilization of existing roads, seismic lines and other cutlines for access. DMI works with QHs, municipalities, oil and gas, energy, Government of Alberta and other key stakeholders to plan and implement the progressive development of permanent all-weather roads to provide access to the FMA, while also taking care to utilize existing access and corridors wherever present.

14.1 Access Development and Road Corridor Plan

The objective for access development is to establish a road corridor of permanent roads for access to the FMA's net landbase and to allow the implementation of the spatial harvest sequence for forestry purposes (Sec. 5.9.8, Alberta Forest Management Planning Standard - Ver. 4.1, April 2006). In keeping with the requirement to outline the road corridors to access each "sub-unit" or operating area on the FMA (e.g. Deer Hill – P2100), the road corridor plan highlights the primary corridors for accessing the FMA. As shown in Figure 1, all but two of the operating areas are currently accessed. The Notikewan-Notikewan River operating area is proposed for access from the north, off of a winter access road through Manning Diversified Forest Product's FMA. Stoney Lakes-Rambling Creek is proposed for access from Sulphur Lake-Notikewin River following existing seismic lines.

Access to the forest from these corridors is accomplished by operators on the FMA through the use of existing cutlines to provide temporary access (less than 5 years) into areas within 10 km of the corridor and when necessary, as far as 20 km. Using this approach provides access to the entire landbase while also reducing the footprint used for access.

While access is a requirement for managing the landbase, roads can sometimes be the source of negative impacts such as fragmentation and increased accessibility to the forest that may result in increased predation and increased risk of wildlife mortality due to collisions. While access to the operable volume in the FMA is a critical element for effective management of the landbase, other values in the forest are also important and are accounted for both in this strategic planning exercise and also at the tactical (5-year) and operational (1-year) planning horizons where operating ground rules must be followed in order to receive the approval to operate.

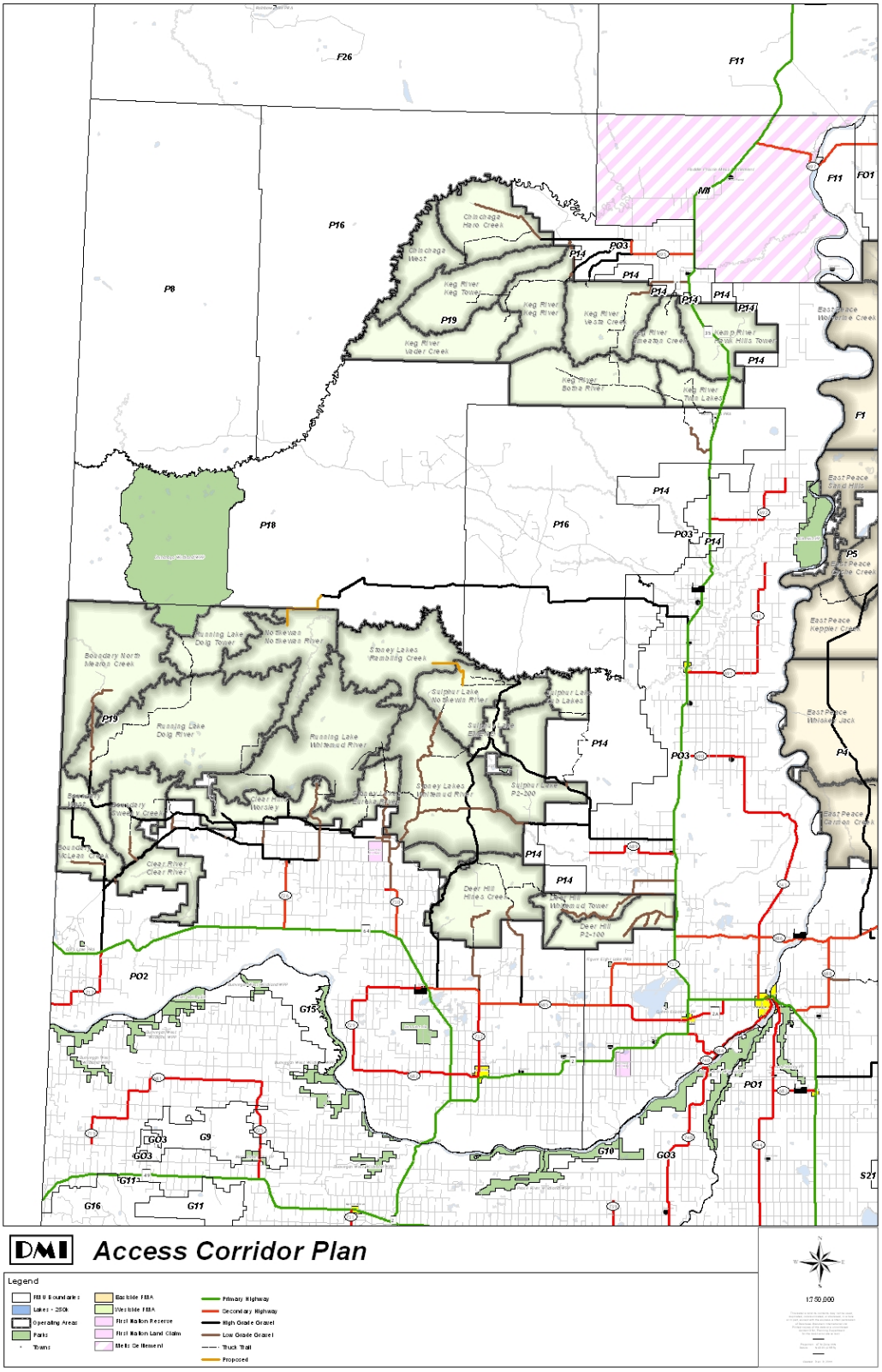


Figure 21. Westside FMA Access Corridor Plan.

14.2 Access Limitations

Forest companies operating on the FMAs are required to follow the DMI Operating Ground Rules (OGRs). The OGRs provide direction and expectations for planning, implementing and monitoring of operations on the FMA and connect them with the Forest Management Plan to ensure strategic objectives are met on the ground.

The OGRs provide direction to timber operators for planning, implementing and monitoring timber operations on timber licence and permit areas in Alberta. They highlight important management principles, define operating and planning objectives, and present standards and guidelines for timber harvest, road development, reclamation, reforestation and integration of timber harvesting with other forest uses.

In addition to the corridor plans, temporary access to the forest from the identified corridors is planned, reviewed and developed in accordance with the OGRs and approved by the GOA on a tactical level within the General Development Plan (GDP) and the Final Harvest Plan (FHP). Within these plans, consideration is given for the following:

- The Operating Ground Rules provide the procedures approved by the Government of Alberta for planning and working within wildlife zones.
- Temporary roads are authorized under approved FHP/AOP and must be operated in accordance with the OGRs.
- Existing cutlines (e.g. seismic)
- DMI Licences of Occupation (LOC) - Access Restrictions
- Limitations on access for other uses (e.g. restrictions for wildlife protection, roadside sanctuaries, gates, etc)

Below are some examples of tools that DMI has invested in the development of to help reduce the impacts of access on other values by ensuring our staff and contractors working in the forest are knowledgeable of the most appropriate methods of operating in the forest:

DMI Operating Ground Rules

Watercourse Crossing Field Guide and Strategy Manual

DMI Forest Resources Field Guide

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15: Forest Protection Strategies

As per the Forest Prairie Protection Act and associated regulations, DMI develops and submits a forest protection plan to SRD annually.

1.1.1 FireSmart

The wildfire threat assessment for the FMA will be completed by ASRD. There are no known community protection plans in the FMA area. If asked to by Peace River ASRD, DMI will incorporate any FireSmart plans into subsequent wildfire threat assessments and work to build FireSmart initiatives into harvest design within any community zone.

15.1 Insect and Disease

DMI will work cooperatively with ASRD to identify and control, where possible, outbreaks of insects and disease.

This is witnessed in the past year by DMI's commitment to pine beetle management through participation in regional committees and modeling of strategies in this DFMP. DMI will continue to participate in this initiative and any others that may arise from time to time.

Details of actions and results are presented in the GDP as required.

1.1.2 Weed Control Plan

DMI will work to minimize the spread of noxious or restricted weeds through annual planning and implementation of an approved weed control plan. The Weed Control Plan will be submitted annually in the GDP.

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16: DMI Retention Strategy

DMI's ecologically-based management processes are designed to extract forest resources while simultaneously maintaining acceptable forest structure and ecological function. The approach is straightforward and relies on the following assumption: If representative 'building blocks' of the natural forest structure are maintained over time, then the ecological processes associated with those structures will also remain present in the forest over time.

DMI's variable retention strategy was developed from a natural disturbance template based on fire and leaves individual trees and/or groups of trees in a cutting area in a variety of configurations. From evaluation of fire disturbances, it was observed that regenerating stands contained standing dead timber, single live trees, and patches of live trees in a variety of combinations. DMI chose to base its variable retention strategy on the premise that a future forest with a level of structural retention similar to that found in fire disturbances will more likely maintain natural processes than a future forest without retention.

Several key principles taken from observed fire disturbances were used to guide the development of DMI's variable retention strategy including:

1) Green tree retention contributes to stand level vegetation complexity, and it is implemented at the stand level. However, retention must be planned and measured within a landscape level context. The coarse filter management benefits are meant to be perceived in the long-term at the landscape scale.

2) Fire disturbance is the dominant stand level initiation agent. Long term, forest wide, coarse filter management approaches are the lower risk option when it is desirable to maintain biodiversity. Following a natural disturbance template will aid forest managers in maintaining natural forest functions. *Fire leaves green tree retention so harvesting will leave green tree retention.*

3) Maintaining green tree retention within harvest areas will increase future stand vegetation complexity. A landscape with highly variable stand complexity will be more likely to support the natural array of biodiversity components than a landscape with lesser levels of complexity.

4) Maintaining green tree retention in harvest areas will serve to mitigate the short-term impacts of harvesting on flora and fauna. Forest fauna in a landscape with retention may be more likely to persist on that landscape than on a landscape without retention. There are many fine-filter indicators that could be used to guide implementation.

In addition, a number of more focused principles and fine-filter concepts that are incorporated in the structural retention strategy include the following:

- Levels and types of retention are highly variable: Natural retention is highly variable within large areas (fire event scale) and within small areas (stand level). Variation is expected in terms of amount (total % live trees left), arrangement (large clumps, small clumps, single tree dispersed), and spatial pattern (even versus clumped distribution).
- Dead trees are very prevalent following fire: Burns have a high component of dead, standing tree that provide for long-term recruitment of down-woody debris. These "snag" trees are in turn hosts for a variety of flora and fauna within a wide range of trophic levels.
- Patches of retention may serve as refuges for biodiversity: Unburned patches also contain unburned forest floor and lesser vegetation and may serve as island refugia at a very fine scale and maintain species presence in the regenerating stand by re-introducing flora and fauna to the surrounding disturbed area.
- Green tree retention together with harvesting to stand boundaries replaces the need for the two pass system: Patches of sufficient size can serve as core area for breeding birds, winter thermal cover for ungulates, travel corridors for mammals entering or crossing large openings, visual screens, and for incorporation and/or protection of special finds (*e.g.* mineral licks, trapper cabins, raptor nests, vernal pools, *etc.*).
- Downed woody debris generated from retention will provide microsites for white spruce recruitment: Fall out of retention trees will provide future supply of downed woody debris that may play a role in white spruce recruitment through nurse log micro sites. Standing retention trees will provide seed source within the harvest areas. The general assumption is that higher levels of structural retention will lead to increased spruce content in the future stand.
- Retention levels and arrangement are highly variable: Natural disturbance leaves a very large variation in the amount, arrangement, and type of retention. Therefore, structural retention needs to be highly variable from stand to stand, but representative of the stand.
- An average of 15% retention is required in harvest areas; 7.5% patches and 7.5% single tree: The requirement for large patch spacing for 'stepping stones' combined with minimum core area, equates to approximately 7.5% retention within a very large opening. Expert opinion suggested that large patch percentage and small+single should be roughly equal. Thus, 15% total retention was selected.

16.1 Variable Retention Strategy

The goal of DMI's variable retention strategy is to maintain forest structure and ecological integrity in the forest following harvest treatment. Based on the above principles and findings from fire disturbances, an objective to maintain 15 % retention in the harvested areas was developed to ensure that some of the merchantable wood is

left in blocks following their harvest treatment. Also in line with the above principles, large patch and small patch/single-tree types of retention were categorized to provide a means for achieving 7.5% retention in large patches and 7.5% retention in small patches and/or single trees. As such, three categories of retention were defined:

- Large Patches
- Small Patches
- Single Tree and Clumps

16.1.1 Large Patches

Large patches are undisturbed forest more than 2 hectares (ha) in size that are representative of the stand being harvested. The primary intent of large patch retention is to maintain areas of interior core habitat within harvest areas, where the interior core habitat is that area within the retention patch that is at least 80m from an edge (*i.e.* the diameter of the patch must be greater than 160 metres). Other benefits provided by large retention includes 'stepping stone' cover for large ungulates, seed source for future regeneration, biological refuge for re-inoculation (soil microbes, ground vegetation, insects, *etc*.) of the surrounding harvested areas, and breaking the line of sight for aesthetic and wildlife values. Additional measures will be taken when possible to locate retention on ground providing other values (e.g. squirrel middens, bear dens, nests, vernal pools, etc.).

16.1.2 Small Patches

Small patches are undisturbed forest areas that are greater than 0.5 ha and smaller than 2ha and that are representative of the stand being harvested. While small patches do not meet the size requirements to provide interior core habitat, they are large enough to require planning prior to harvest. As is the case with large patches, additional measures will be taken when possible to locate retention on ground providing other values and benefits (e.g. squirrel middens, bear dens, nests, vernal pools, etc.).

16.1.3 Single Tree

Single tree is a term used to describe retention left as either single tree or clumps (i.e. small collections of stems up to 0.5 ha). While the retention prescription will be planned and identified in advance of the harvest, the harvest operators will be trained with simple procedures to achieve the targets prescribed. As such, operations are provided some flexibility to utilize retention to protect smaller sensitive sites during the course of the harvest operation (*e.g.* vernal pools) and to protect understory conifer.
As shown in Table 34, the landscape level targets for variable retention are for 15% at the landscape/compartment level, made up of an equal proportion of large patch and small patch/single tree retention.

16.2 Guidelines

In order to meet the objective of "variability" of retention while still meeting the landscape objective of 15%, flexibility is required in the application of the variable retention strategy. However, to ensure a level of consistency in application and to provide an avenue for effective monitoring, guidelines and limits on implementation are also required. The following points identify considerations in planning and implementation of the variable retention strategy:

- Retention will be representative of all harvested stand types.
- Retention left in blocks may range from 0 – 30% of the block area.
- Measurement of retention will be at the compartment level and can range from 5 – 20% of in any one year with a 5 year minimum of 15% to ultimately meet the 10 year objective of 15% of the harvested area by compartment being left as retention.
- Retention may be left in any one or combination of the following arrangements (Figure 22. Example of large and small patch retention located as islands and as proximal.:
    - Dispersed – spread out throughout stand.
    - Island aggregate – patches within stand but not connected to stand boundary.
    - Proximal aggregate- patches within stand and connected to stand boundary.
- Conifer retention should be left in larger patches and where possible with AW as it has a greater risk of blowdown.
- Retention will be accounted for from area in the net landbase only. Areas that are not part of the active landbase (*e.g.* buffers, breaks, *etc.*) may not be used.
- Active landbase used as buffer for environmentally sensitive sites or wildlife areas may be counted towards the retention target. (*e.g.* Hibernacula, den sites, raptor nests, unmapped streams, *etc.*)
- Proximal retention is a consideration for use where:
    - A waterbody runs into or along the block and retention is left in addition to the required buffer.
    - Sensitive sites, as identified in the operating ground rules, are within 100 metres of the block boundary.
    - The company chooses to leave a small or large patch along the block edge.
- Proximal aggregate retention limitations:
    - Proximal retention may not exceed 1/3rd of the retention target in any compartment.
- Total retention within a block may be comprised of single trees, small patches or large patches. Any single block may contain one, two, or three of these retention configurations.
- One (1) tree within the single tree prescription is considered to be equivalent to 20 square metres for reporting purposes.
- Patch retention may overlap or be placed adjacent to merchantable timber ground rule deletions (e.g. mineral licks, water buffers) where it is advantageous to do so. Likewise, it may be advantageous to place retention adjacent to non-merchantable deletions (e.g. alder clumps) to maximize benefits (e.g. improve hiding cover/line of sight).
- Retention will not be rescheduled for harvest outside of the parent stand rotation.

- Retention may be used to accomplish other forest management goals such as understory protection.
- Retention left for understory protection will count toward to 15% target.
- Dead trees standing will count as retention and will be given selection priority when choosing single-tree retention.
- No equipment, logging debris or top piles will enter a large retention patch.
- Retention patches larger than 0.5 ha will typically be planned prior to harvest.
- There is no specific tie between block size and retention required - ie larger blocks do not arbitrarily require a higher percentage of retention.
- The objective for arrangement of single-tree is for an even distribution of stems across the block of representative timber types.

Table 34. Summary of DMI variable retention within block types and targets.

Retention Type (within-block)		Spatial Area Definition	Proportional Target (5-year)
Single Stems	Single Stems	20m2/stem (0.002 ha/tree)	50% of total retention (= 7.5%*)
	Small Clumps	< 0.5 ha	
Small Patch		0.5 ha to 2.0 ha	
Large Patch		> 2.0 ha	50% (= 7.5%*)

** -all target percents are applied as spatial area (ha) of the merchantable harvest area*

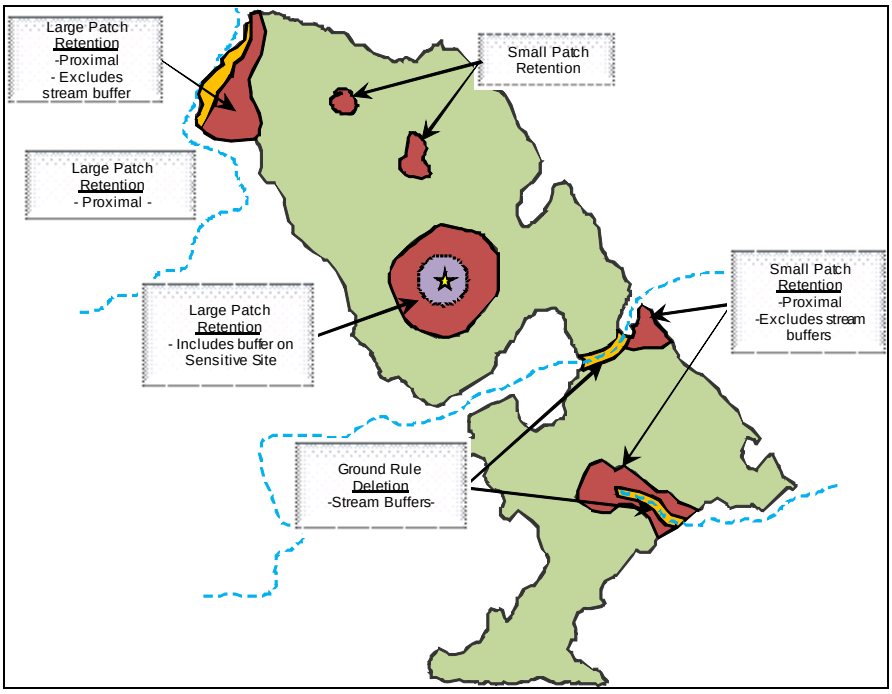


Figure 22. Example of large and small patch retention located as islands and as proximal.

16.3 Annual Retention Planning

Retention planning is an ongoing, iterative process. Block level plans will be prepared as part of the annual silviculture and operating plan. The overall retention plan will be annually updated when as-built information is received. Retention measures will be completed annually as part of the cutover update procedure. Planners will receive the best estimate of current running tally on retention and they will then use this information to adjust the subsequent years' retention prescription so as to achieve the 15% compartment level 5-year target.

The annual re-planning of retention to meet 5 year targets will be reported as part of the AOP process. The 5-year stewardship report will also contain a detail break down of the previous 5 years' retention planning activities.

Within any one years' blocks, planners will have flexibility to modify retention levels to suit logistics and business needs. Patches will still be planned and movement of retention patches will be handled through block amendments. Individual tree retention may be reassigned between blocks. Any changes will be reported on in the next update and submission. The overriding principle will still be to meet the representative 15% target at the 5-year block population level.

16.4 Retention Monitoring

Planning and reporting of retention will require several products annually. These will be included in the annual GDP:

- Retention to date by retention type by timber type (broad cover group) by block : As-Built Retention Table
- Revised Projection of harvest blocks by timber type : Annual Harvest Projection Table
- Review of results to-date and focus for future years to meet targets.
- The Stewardship report will contain a detailed summary of the retention results versus planned retention for each five-year reporting period.

16.5 Measurements

Retention will be measured by area as it represents the most logical and meaningful approach in consideration of ecological services. The present approach to measurement of retention utilizes a photo-interpretation approach to inventory the retention on every harvest block. Using the aerial photography cutover updates interpretation is used to identify retention. This process allows for the verification of planned patches, identification of unplanned patches (e.g. retention left around a sensitive site found during harvest), delineation of single-trees (1-9 trees) and clumps (10 or more merchantable stems). Only trees of merchantable species greater than 14m tall will be considered to ensure that the retention count is representative of what was harvested.

Area summaries are produced from the interpretation where single stems are assumed to accumulate 20m2 (1/500th ha) towards the retention total. The interpreter also provides a broad cover type call for the small patches and single stems combined at the block level. Large patches will retain the original AVI broad cover type call.

While this methodology effectively captures the retention left on the landscape in this variable retention approach, alternative approaches are under consideration. If an alternative process proves itself to be valid, it could replace the current system sometime in the future.



Figure 23. Panoramic view of Block FMAP05-0102-18, July 2007 showing multiple forms of retention.

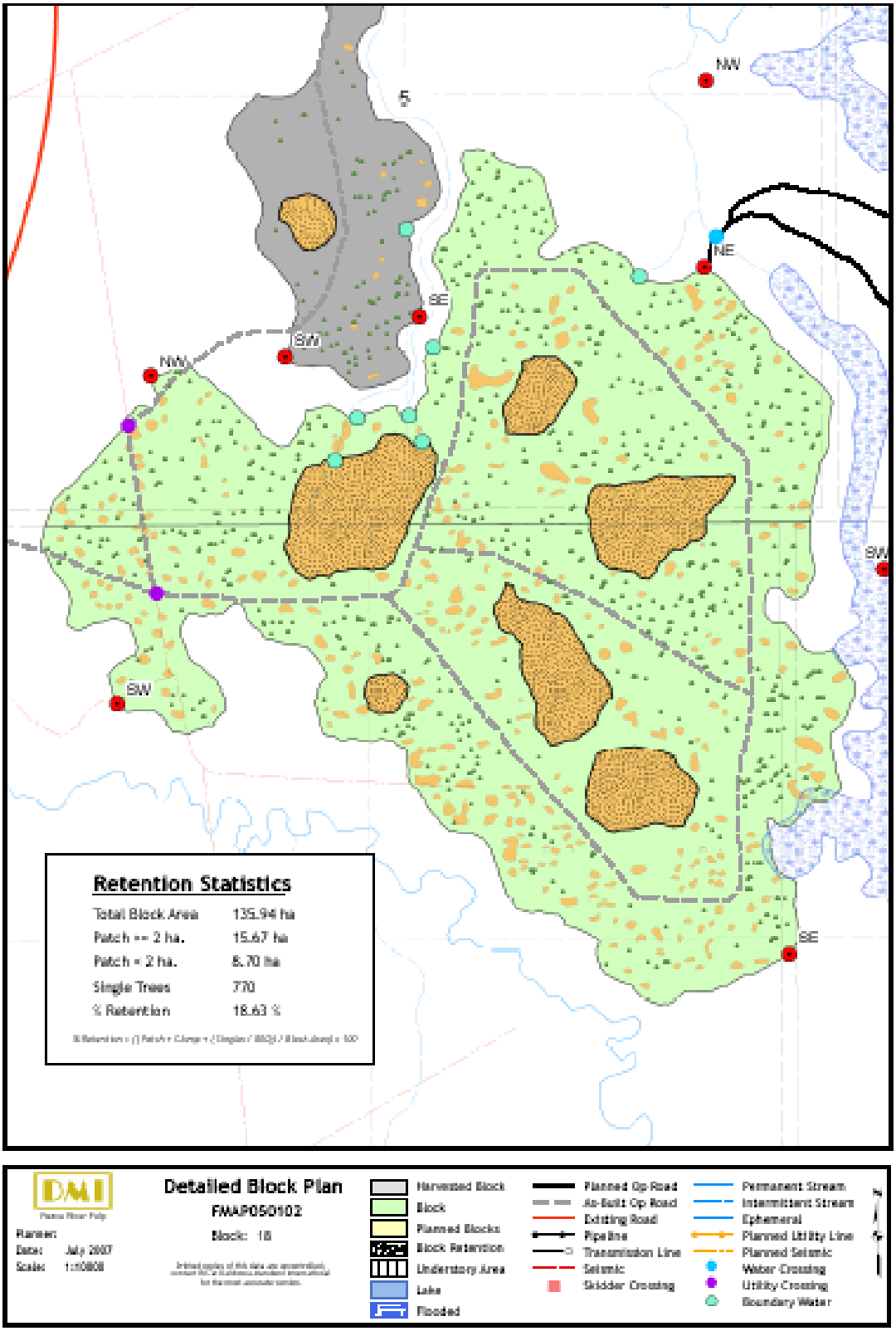


Figure 24. Sample retention measurement map product showing merchantable retention categorized as large patches (orange with stipple), small patches (orange) and single tree (green dots).

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17: Quota Holder Retention Strategies

17.1 Tolko's Merchantable Structure Retention Strategy:

Merchantable and non-merchantable structure shall be retained in harvest areas during operations (including salvage operations).

a) An average of 1% of the merchantable coniferous and 1% of the deciduous volume shall be retained within harvest areas across the landscape.

b) The amount and species of merchantable structure retained within individual harvest areas and compartments will vary between 0-3 %.

c) An average of 5% of the total area harvested across the landscape shall be retained as residual material. Residual material, where it exists on the landscape can include lesser vegetation, standing dead, broken, or decaying trees, tree identified as having dens or nests, viable understory, or other unique flora and/or terrain features.

17.2 Zavisha Sawmills Retention Strategy

Overall retention will be equal to or greater than 2% within our operating area, based on a five year period.

Retention per block will vary from 0% to 50%.

Zavisha will identify opportunities for within block retention where appropriate.

All structured retention will be operational. Retention patches will be feathered to ensure wind-firmness.

Retention patches will be selected, keeping block composition in mind, based on the following criteria:

- Ensuring limited line of sight (no more than 400 m)
- Leaving areas that are difficult to reforest (low and or soft ground, steep slopes)
- Targeting Aspen patches

- Preserving younger stands and more mature stands with regen
- Leaving wider buffers around watercourses
- Retaining larger patches (Rather than leaving small patches or single trees, Zavisha will strive to leave larger patches to enhance habitat retention)

Special circumstances: All blocks designated as Mountain Pine Beetle blocks will have zero retention of infected pine . However, buffers will be left on steep slopes, water courses and areas where the species is mostly spruce and other non-target species.

Retention patches will be left in those areas during ongoing operations.

Retention patches will be measured by GPS post harvest or soft copy process and an updated table will submitted with the following year's GDP.

This retention strategy, varying from DMI's 15% retention commitment, is based on a business decision as we do not have enough AAC to designate to retention.

18: Sensitive Species Management

DMI's activities occur on a landscape that is subject to multiple sectors of overlapping land use, and under a forest tenure system that *excludes* the forest industry from direct roles in fisheries and wildlife management (that accountability is retained by the Minister[1]). As a result, DMI is limited in its ability to adequately manage for sensitive species until such time as the following tools are completed:

- Scientifically validated definition of suitable habitat requirements per species (physical attributes of habitat),
- Regulator-defined objectives and targets per species, as a product of Ministerial management plans that are applicable across all industrial and public landuser sectors (quantifiable habitat or population amounts), and
- A functional integration between all sectors to provide reasonable assurance of achieving the desired forest structure targets, maintaining adequate habitat condition into the future and contributing to species population health.

Currently, these are largely under development in Alberta - particularly for species-at-risk and species of special management concern. Consequently, DMI recognizes some significant limitations in its capacity under the current landuse framework, the extensive regional landscape activity levels, and the limited state-of-knowledge for many of these species. While habitat is intrinsically linked to species population viability, it is arguably only one determinant in the larger issue of sustainability. The amount and condition of that habitat in the future is also not entirely determined by the forest management tenure holder. All of these factors collectively impede the company's ability to meet some of the core values and requirements in the Planning Standard, particularly those that pertain to *biodiversity conservation* for high value species. Nevertheless as a forest-tenure holder, DMI is clearly motivated toward exercising responsible stewardship and practices in operating on public forest landbases. In support of that stewardship interest, the company's history includes extensive collaborative contributions to improve scientific understanding and practices associated with ecosystem function and habitat aspects for such

[1] DMI FMA Section 8 (1) (c) Rights Over The Land; "….the Minister reserves all land rights on the forest management area….,including by way of example,…: the right to maintain and enhance fish and wildlife resources;" (Forest Management Agreement O.C. 424/89 including amendments to O.C. 226/99), >Wildlife Act, Part 2, Section 7 (1) Property in live wildlife; "Subject to this section, the property in all live wildlife in Alberta is vested in the Crown." (Relationship of the Crown to Wildlife), >Fisheries (Alberta) Act, Section 2 (b); "….the Minister, on behalf of the Government of Alberta, may enter into an agreement with the Government of Canada providing for the management of fisheries….." >Sustainable Resource Development Business Plan 2007-10, Core Business Three –Fish and Wildlife; "The Ministry manages fish and wildlife species on the best available science and integrated decision-making processes." Current relevant Ministerial strategies: Strategy 4.3; "Develop and implement fish and wildlife management plans and species-at-risk initiatives." Strategy 4.9; "Identify and initiate critical actions to develop a biodiversity strategy (planning, delivery and monitoring)"

species. DMI's particular ecological-based management approach, its incorporation of habitat elements into forest-state modeling, and its variable retention strategy are all visible examples of leadership and excellence in this area.

DMI believes that formal integrated partnerships and Ministerial fish/ and wildlife management plans[2] are necessary to determine reasonable biodiversity objectives and targets The significant extent of cumulative linear disturbance that has largely occurred outside forest-sector activities as evident through DMI FMA landscape analysis reveals the local potential for historical landscape habitat modification. This circumstance presents the historical case that establishing habitat/species objectives, indicators and targets other than through cross-sector biodiversity management plans is ineffective. Nevertheless, the company provides the following sections to clearly define the strategic and tactical actions that are used by DMI to contribute to the interests of sustaining these particular biodiversity values.

This section specifically provides a summary of corporate strategies and practices that address sensitive species. The species addressed in this section include:

- Woodland Caribou,
- Grizzly Bear,
- Trumpeter Swans, and
- Species of Special Management Concern (as defined in the provincial Ground Rules document).

18.1 Woodland Caribou (*Rangifer tarandus caribou*)

Woodland caribou is currently listed as a threatened species in Alberta and is considered a species of special concern in DMI's Westside and Eastside FMAs. Caribou habitat-use of the forest is associated with foraging, reproduction and predator avoidance. Opportunities for forest management to address these needs is affected by the level and certainty of knowledge of those habitat requirements (physical attributes, spatial, temporal dynamics), the abundance of habitat features[3] and the degree of other non-forest sector disturbances on that landscape.

Alberta boreal caribou populations have demonstrated strong links to their core home-ranges and do not typically migrate between ranges, even following the effect of large fire disturbances on lichen forage availability. Since caribou feed primarily on lichen during the winter, wetlands (e.g. fens and bogs) and mature conifer forests tend to form their dominant habitat. Woodland caribou traditionally practice spatial separation from other ungulates through differences in forage selection, which provides indirect spatial separation from associated potential predators, diseases and parasites.

With consideration of their requirements for habitat, the primary areas where forest management

[2] Landscape strategies, habitat conservation objectives and wildlife/fisheries resource management is a functional area of accountability within the Resource Integration and Planning section, Fisheries Management/Wildlife Management, Fish & Wildlife Division, SRD (MJEP Benchmark, Job Description M420-17, section staff mandate)

[3] Sleep Darren JH -PhD, NCASI; "State of knowledge and analysis of current research on woodland caribou in Canada"; Techn Bulletin 939, Sept 2007

can have an impact includes the following:

- Altered habitat and effect on lichen winter forage source availability
- Reforestation practices as well as natural post-harvest succession, which presents different understory plant assemblages results in a modification to their forage and increased overlap of habitat use between caribou and other ungulates/predators, and
- Fragmentation of the forest landscape resulting from linear disturbances that translates to increased success of predation.
- Widespread sensory disturbance throughout any single herd-range,
- Sensory disturbance during calving season (latter April to mid-June),
- Sensory disturbance during calve-rearing season (latter April to mid-July)

18.1.1 Caribou Herds

DMI FMA activities occur over 'parts' of four caribou ranges in the region; the Red Earth herd on the Eastside FMA and on the Westside FMA, the Chinchaga, and Deadwood/Dixonville herds, none of which are entirely contained within the DMI FMAs.

18.1.2 Current Gaps in Knowledge (limiting factors to efficacy of forest landscape management strategies)

- Arguable data-deficiency[4] in current data on herd size, health, movement patterns and true range definition for one FMA herd: Deadwood-Dixonville (Very low, non-current data forms current definition of geographic range and herd health status)
- Current and reliable geographic definition of caribou range extent, movement patterns and identification of core-habitat areas (esp. forage and reproduction) within local ranges is imperative background to design and deployment of effective, viable landscape habitat strategies per herd.
- Caribou foraging ecology; -Lack clear understanding of full diversity of caribou forage species, annual cycles in nutritional requirements and the significance of boreal vascular plant assemblages to fitness particularly during non-frozen seasons (spring, summer, fall).[5] This could provide improved insight toward caribou-beneficial forest-structure strategies and silvicultural practices.

[4] DMI participated in interim 2007 working group to form Terms-of-Reference and initial program for Research & Monitoring Subcommittee (Alberta Caribou Committee). Assessment of current state-of-monitoring datasets is underway via RMS staff PhD (McCutchen). Initial indications show positively robust datasets on population size for Red Earth and Chinchaga herds (FMA landbase). Hotchkiss (non-FMA landbase) herd has a recently improving but yet rather young data-set that is indicating merit in revisiting historical herd-range boundaries.

[5] NCASI (National Council for Air and Stream Improvement) –"A review of ungulate nutrition and the role of top-down and bottom-up forces in Woodland caribou population dynamics", Technical Bulletin 934, June 2007 + Sleep Darren JH -PhD, NCASI; "State of knowledge and analysis of current research on woodland caribou in Canada"; Techn Bulletin 939, Sept 2007 (National Council for Air and Stream Improvement)

- Validation of possible increases in moose/deer populations as a response to new early seral succession forage, which may increase predator populations and contribute to higher caribou:predator encounters.
- Cumulative efficacy of the full suite of intervention and management tools (BMP's, predator & ungulate control, linear restoration, landscape forest-state modeling) is unknown.
- No quantified targets for caribou recovery efforts, habitat conditions or habitat quantity are defined yet in the province.

18.1.3 DMI Actions in Forest Management and Practices

18.1.3.1 Key Mitigation Principles

1. The *Alberta Caribou Committee* (ACC) is the organization commissioned by the Minister to execute the central role in designing, recommending and coordinating assessment monitoring, caribou recovery strategies, short-term interventions, research and industrial practices. This mandate includes directing the formation of 'regional' collaborative efforts to achieve provincial objectives (habitat availability, herd recovery).
2. None of the four regional Woodland Caribou ranges are wholly contained within the DMI FMA. Therefore landscape habitat strategies cannot be viably developed without a coordinated effort to engage and integrate all relevant forest landbase management proponents under a single caribou strategy per range and sharing common objectives.
3. **Effective caribou recovery actions need to be formed and implemented under a coordinated, integrated (*cross-sector*) strategy involving a suite of long-range landscape-scale strategies and operational practices that provide continuous supply of 'suitable' habitat at large spatial scales as well as landscape 'conditions' favourable to species persistence. In isolation, the forest management plan (FMP) cannot effectively ensure sufficient habitat availability and suitable habitat condition due to industrial land activity factors beyond the control of DMI.
4. Accurate and 'current' spatial delineation of caribou habitat and landbase-use by the species are fundamental to defining actions and where to commit strategic investment.

18.1.3.2 General Actions

While the specific nature of DMI's tenure excludes the company from operating in conifer-dominant stands, the company's activities require access through defined caribou ranges and the company regularly integrates with overlapping conifer tenure-holders in the region. Consequently, DMI has historically collaborated (since 1994) on Woodland Caribou recovery initiatives and will continue to do so. Specifically this includes:

- Monitoring and research -continued fiscal and in-kind support to participate in provincially coordinated activity within the region (currently Alberta Caribou Committee)
- Planning tools and forest practices -collaboration with researchers and established action-organizations, toward development of integrated, well-coordinated planning tools and improved beneficial management practices (BMP's)

- Herd-specific strategies -corporate participation in future regional *Landscape Range Teams* to co-develop and contribute to the design of herd-specific strategies for landscape-scale habitat availability & habitat conditions meeting provincial objectives.

18.1.3.3 Specific Actions within Caribou Range

- Strategic Actions:
    - In recent history, DMI has contributed funds to the Alberta Caribou Committee for use in caribou collaring, preparations for regional planning forums, and industry representation capacity. The company has also provided extensive landscape inventory and footprint datasets in-kind to Alberta for preparations of background baseline that will support regional planning forums. DMI has provided numerous letters-of-support to the ACC and UofA project leaders in pursuit of grant funds for various caribou baseline initiatives. The company also accepted the Minister's invitation to participate in Alberta implementation plans for the Alberta caribou policy framework.
    - Improved spatial definition of local caribou ranges (caribou data and habitat use) is anticipated to occur through DMI's contributions and collaborative participation in relevant provincial caribou research projects.
    - Government- defined caribou herd-ranges are included as part of DMI's "High Conservation Value Forests" (HCVF) system that delineates geographic areas of special biodiversity significance. This is an internal planning tool that provides staff guidance on special planning and operational considerations for caribou ranges.
    - DMI will continue to lend support to future integrated planning forums that seek to design and implement holistic strategies at the caribou range level or other geo-administrative boundaries that will benefit local caribou recovery and persistence. DMI will consider and respond to relevant requests for forest landscape datasets where they will present value to support long-range modeling efforts and company due diligence.
    - Currently DMI is participating in related national and provincial initiatives as a signatory to the Canadian Boreal Forest Agreement. The CBFA seeks to accelerate development of integrated, well-coordinated science-based caribou action plans that also consider forest sector economics and stability of forest dependent communities.
    - The company will participate through forest sector representation in collaborative regional and provincial forums to devise long-range forecasts of projected forest structure that address habitat requirements and future forest state within the context of a functional, holistic, integrated strategy.
    - The company will consider and respond to requests for silviculture expertise and collaboration in linear footprint restoration initiatives that become operational in the region as driven by the regional forums (e.g. Boreal Reclamation Program -nova-NAIT, Boreal Research Institute).
    - Forage plant-community assemblages and lichen forage source availability (forest cover : seral class maintenance) show good future potential to be managed through

development of effective landscape and stand-level harvesting and silviculture practices. Undertaking an 'ecosystem' approach that strives to reproduce a mosaic of traditional patterns and structure for vegetation (including quality of understory forage assemblages) similar to that created by natural fires, is a valid strategy since boreal caribou have evolved on a landscape that includes extensive wildfire disturbance.

- DMI's Forest Management Plan seeks to perpetually retain old seral class representation across the landscape for all broad cover types, in variable quantities and locations within the Natural Range of Variation (NRV) as one ecosystem-based management strategy. This may offer value to caribou.
- Landscape connectivity will be maintained by a variety of strategic measures in DMI's Forest Management Plan, including by example, the protection of waterways, conservation of wetlands and a landscape-scale structural retention strategy. These ecosystem-based strategies may offer value to caribou.
- Significant proportions of DMI FMA tenures are retained as landbase that is designated non-contributing to timber supply. A number of key biophysical attributes key to boreal caribou habitat are included in this consideration.

- Tactical Actions:
  - Continued preparation of Caribou Protection Plans (annual) submitted to Alberta regulator field-staff for all activities occurring within defined caribou ranges. This assists staff awareness of caribou sensitivities in developing range-specific, Operating Area specific prescriptions to reduce or prevent caribou impacts.
  - Operation scheduling and activity coordination between forest companies to reduce events of multiple-entries and repeated direct disturbance of caribou during late winter (reduces cumulative season subjected to sensory disturbance)
  - Operation scheduling and access-selection to concentrate access with other known industrial users, and reduce spread of sensory disturbance within any single herd-range
  - Operation timing and adequate contractor-resource deployment within caribou range to ensure early completion (avoid sensory disturbance during calving season -latter April to mid-June)
  - Operation scheduling to avoid activity and sensory disturbance during entire calving + rearing season (latter April to mid-July) within any Alberta-identified core calving habitat areas.
  - Retention design consideration to preserve stand pockets with high arboreal lichen and good windthrow potential.
  - Line-of-sight reduction on linear (access) development to meet regulator instructions in the interests of reducing predator sight-distance advantage.
  - Prompt aggressive reclamation of access on completed use in the interests of reducing predator travel-advantage and encouraging efficient forest vegetation recovery. (including rollback)
  - Field monitoring of contractor activities and progress management to ensure compliance with caribou Industrial Best Management Practices and Caribou Protection Plans.
  - Advisory signage posted along haul routes entering caribou habitat (staff and public awareness)

18.2 Boreal Grizzly Bear (*Ursus arctos*)

18.2.1 Alberta (SRD) Expectations

Forest Management Plan strategies and *Spatial Harvest Sequence* are to describe the harvesting program that will create the desired future forest, considering among other values the habitat for species of special management concern. The province desires corporate definition of Indicators and Targets, as well as long-range forecasts of projected forest structure that address habitat requirements for measuring performance in achieving core values and objectives for this species.

- Geographic Scope is specified as *grizzly bear range*, presumably the range defined in the documents: Draft-2005 *Alberta Grizzly Recovery Plan*, 2002 *Status of the Grizzly Bear in Alberta*. Such range is not currently delineated on provincial land-use referral maps.
- At the time of this DFMP submission, the region has been undergoing northern boreal Grizzly Bear research.[6] Under the direction of the Minister that research is anticipated to contribute to landscape-scale objectives for grizzly habitat-condition including access strategies for core grizzly range identified by that research.

18.2.2 Local Context

A portion of DMI's Westside FMA occurs over northwest Alberta Grizzly Bear range.

18.2.3 Current State of Knowledge (species sensitivities and risks)

- Boreal Populations Character: Critical habitat in northern Alberta is only coarsely delineated to-date. Boreal grizzly populations are currently the subject of a provincial study initiative. While incomplete, the project is indicating that 'boreal' populations (DNA-based sub-populations) may be unique relative to foothills or montane grizzly populations both in their habitat range-sizes and their temporal movement patterns across the landscape (habitat use). Grizzlies are habitat generalists, preferring forest edges during foraging season, but otherwise demonstrating high flexibility in the types of resources used depending on the ecosystem, season and level of human disturbance.[7] They are highly mobile in their trophic pursuits, utilizing a large variety of vegetative, vertebrate and invertebrate sources as they become available through the course of the non-frozen season. Northern boreal populations are hypothesized to range over significantly larger landscapes than southern populations, including suspected migration between Alberta and northeast BC using higher-elevation topography features and dominant riparian corridors to assist that movement[8].

[6] Foothills Model Forest (FMF); Alberta Grizzly Bear Research Program
[7] Personal communications, 2006; Scott Nielsen, University of Alberta, FMF –Resource Selection Function model specialist
[8] Personal communications; 2006, 2007 Dr. Gordon Stenhouse, Grizzly Bear Research Program Manager, FMF

- Species Sensitivities: Key manageable issues are
    - Sensory and den disturbance during winter and spring denning season,
    - Altered habitat and attractant effect through increased forest openings and forage source availability -forest density associations, early seral class understory plant assemblages,
    - Reforestation practices as well as natural post-harvest succession, which presents different understory plant assemblages (forage biomass volume, variety and quality), and increased ungulate (prey) opportunity,
    - Line-of-sight in newly created bear foraging areas (harvest blocks),
    - Access locations relative to core bear habitat and movement corridors, and
    - Open access (linear disturbances) =additional early-seral forage attractants, increased human use (public, industrial), and consequential increased human:bear encounters (increased bear mortality risk)

18.2.4 Current Gaps in Knowledge (limiting factors to efficacy of forest landscape management strategies)

- Active research in northern Alberta is currently attempting to address data-deficiency in current understanding of population size, health, boreal movement patterns (habitat use) and current range definition for northwest Alberta populations.
- Proposed *Grizzly Bear Conservation Areas* (GCA)[9] have not to-date been officially delineated as the defining core habitat areas of high probability grizzly occurrence. Northwest Alberta data is improving but yet rather young and is indicating merit in revisiting historical range boundaries, since grizzly use of the full-range currently defined for this region is suspect or may have changed. Refined geographic definition of grizzly range extent, movement patterns and identification of core-habitat areas for the region are imperative background to design and deployment of effective, viable landscape habitat strategies.

18.2.5 Validation of topography and dominant riparian corridors connection to suspected bear habitat use and travel corridors within northwest boreal landscape is lacking.

- Landscape-scale modeling tools exist for this species elsewhere, but have not to-date been calibrated for use within the region (Resource Selection Function-RSF model, Mortality Risk Predictive tools, movement corridor maps).
- No quantified targets for bear recovery efforts, habitat conditions or habitat quantity are defined yet in the province.

[9] Draft-2005 Alberta Grizzly Recovery Plan

18.2.6 DMI Actions in Forest Management and Practices

18.2.6.1 Key Mitigation Principles

1. The *Alberta Grizzly Bear Recovery Team* is the organization commissioned by the Minister to execute the central role in designing, recommending and coordinating grizzly assessment monitoring, recovery strategies and industrial practices. This mandate includes developing recommendations on provincial objectives (habitat availability, species persistence)
2. **Effective grizzly recovery actions need to be formed and implemented under a coordinated, integrated (*cross-sector*) strategy involving a suite of long-range landscape-scale strategies and operational practices that provide continuous supply of 'suitable' habitat at large spatial scales as well as landscape 'conditions' favourable to species recovery. In isolation, the forest management plan (FMP) cannot effectively ensure sufficient habitat availability and suitable habitat condition due to industrial land activity factors beyond the control of DMI.
3. Accurate and 'current' spatial delineation of core grizzly habitat and landbase-use by the species are fundamental to defining actions and where to commit strategic investment.

18.2.6.2 General Actions

DMI has collaborated for the past 2 years on northern boreal Grizzly Bear initiatives and will continue to do so. Specifically this includes:

- Monitoring and research -continued fiscal and in-kind support to participate in provincially coordinated activity within the region (Alberta Grizzly Bear Research Program -FMF)
- Planning tools and forest practices -collaboration with researchers and action-organizations toward development of planning tools and improved industrial Beneficial Management Practices. **Dr. Gordon Stenhouse has offered to work with DMI directly, during the development of regional landscape strategies and deployment of tools distinct to northern boreal Grizzly Bear habitat.[10]
- Region-specific strategies -corporate participation in future integrated-sector planning forums for *Regional Grizzly Bear Recovery* to co-develop and contribute to the design of a region-specific strategy for landscape-scale habitat availability & habitat conditions meeting provincial objectives.

18.2.6.3 Specific Actions within Core Grizzly Range

- Strategic:
    - Improved spatial definition of grizzly core-range (boreal data adequacy) through DMI contributions to the established collaborative provincial research/monitoring program
    - Core habitat (Grizzly Bear Conservation Areas) will be included as part of DMI's "*High Conservation Value Forests"* (HCVF) initiative to delineate geographic areas of special biodiversity significance as an internal planning tool.

[10] Personal Communication with Dr. Gordon Stenhouse; fall, 2007

- Collaborate in development and testing of 'predictive landscape planning tools' through DMI contribution to established research/monitoring program
- Active DMI participation in future integrated planning (regional grizzly recovery implementation forums) to design holistic strategies for core grizzly habitat within the region that would be implemented across industrial sectors. DMI will contribute forest inventory data and long-range forest-state modeling capacity to this effort.
- The company will participate in collaborative efforts to devise long-range forecasts of projected forest structure that address habitat requirements and future forest state within the context of a functional, holistic, integrated strategy as driven by the Alberta Grizzly Bear Recovery Team and the Minister.
- 'Future' permanent-class road infrastructure planning will deploy 'predictive tools' for avoiding right-of-way placement within any identified critically sensitive grizzly habitat or movement corridors, thereby reducing risk of creating high-potential grizzly mortality areas. (Pending Tools: Grizzly RSF maps, movement corridor maps, Predictive Mortality Risk model, core range identification)
- The company will provide silvicultural expertise and collaborate in linear restoration initiatives (productive forest landbase returns) that become operational in the region as driven by the Alberta Grizzly Bear Recovery Team. (redundant footprint reduction)

- Tactical
  - Harvest-block retention design and placement to reduce line-of-sight and increase cover in early post-harvest seral vegetation for potential foraging grizzly bears (Pending Tools: Grizzly RSF maps, movement corridor maps, core range identification)
  - Establishing no-harvest buffers to preserve all bear den discoveries, regardless of bear species
  - Line-of-sight reduction on 'temporary' linear (access) development to meet regulator instructions
  - Prompt aggressive reclamation of access on completed use in the interests of reducing human:bear encounters and encouraging forest vegetation recovery.
  - Continued annual bear-awareness training for staff and contractors in the interests of reducing bear attractants as well as increasing understanding of bear encounter prevention and encounter response, and
  - Field monitoring of contractor health & safety programs for preventative bear encounter practices (camps, field crews), and
  - Collaboration with regulators on designing effective future access-control initiatives for 'existing' permanent access routes within identified core grizzly habitat of high mortality risk (current habitat condition analysis pending Predictive Mortality Risk model).

18.3 Trumpeter Swans (*Cygnus buccinator*)

18.3.1 Alberta (SRD) Expectations

Forest Management Plan (landbase description) is to address the assignment of "non-contributing" lands that are to be excluded due to buffers around 'known' wildlife features (establishment of net harvest-available landbase).
Operational Forest Harvest Plans (FHP) are to describe the harvesting program that will create the desired future forest, considering among other values the habitat for species of special management concern.

- Geographic Scope is described in the form of "trumpeter swan observation points" and "trumpeter swan survey areas" defined in the documents: *Alberta Trumpeter Swan Recovery Plan* 2005-2010, *Status of the Trumpeter Swan in Alberta*, 2000. While survey area ranges are not currently delineated on provincial land-use referral maps, scope for forest management activities planning is specified by regional SRD biologist staff. Point location habitat (breeding/nesting and non-breeding) is identified on provincial land-use referral maps.

18.3.2 Local Context

DMI tenures contain a well-documented but spatially-dynamic collection of dispersed (isolated) and clustered locations of historical Trumpeter Swan habitat features. They exist within both FMA and non-FMA regional landbases. Trumpeter Swans in the FMA area are geographically grouped by designated survey areas; Peace River, High Prairie. Non-FMA activities may occur also in swan survey areas designated as High Level and Grande Prairie.

18.3.3 Current State of Knowledge (species sensitivities and risks)

- Boreal Populations Character: Boreal swans are a seasonal occurrence within the region, as they are a migratory species that uses the boreal region for summer range (breeding, nesting, forage during migration). Pairs may select and inhabit a wetland location for several years prior to nest initiation and breeding.[11] Certain lakes and wetlands have been documented to see annual traditional use during spring and fall migrations (stop-over sites). Resting and feeding sites during migration are critical to energy reserves for breeding. Nesting habitat sees habitual-use behavior and multiple-year fidelity. Due to extensive daily forage intake (to 9kg), nesting habitat point locations see rotational-use along with staging, migration and moulting locations as the cycle of aquatic vegetation forage is depleted and renewed over a period of years. Nesting typically occurs near shore, on islands or muskrat/beaver lodges. Permanent abandonment of breeding wetland locations, or reduced foraging and resting behavior at other non-breeding sites, are both a risk under severe repeated disturbance. Key determinants in habitat selection include; wetland size/depth, aquatic vegetation

[11] Alberta Trumpeter Swan Recovery Plan 2005-2010, Ab Species at Risk Recovery Plan No. 11, 2006

abundance and accessibility (emergent, submergent), invertebrate abundance, water depth stability, water quality (un-polluted), potential nesting structure, low human disturbance.

- Species Sensitivities: Key manageable issues are
    - Sensory disturbance (sound, site) during nesting season (April 1 to Sept 30)
    - Riparian vegetation screening (long-range aquatic habitat quality/effectiveness maintenance)
    - Water quality (pollution prevention)
    - Water quantity (as a factor of road cross-drainage engineering and management)

18.3.4 Current Gaps in Knowledge (limiting factors to efficacy of forest landscape management strategies)

- Regional point-location data has a problematic history in 'accurate' correlation of recorded points to actual water features (versus upland). Operational use of this data in planning decisions will require ongoing point-in-time consultation with Area (regional) SRD Biologist staff.
- Landscape-scale modeling tools do not largely exist for this species, nor do predictive landscape tools exist for identifying potentially suitable (high probability) breeding habitat.
- Dispersal of immature swans is not well studied (migratory patterns of habitat selection and recurrent use).
- Quantified understanding of the effects of predation and human-caused mortality at population level is weak.
- Feasibility of habitat creation/enhancements as a tool to facilitate population growth and distribution is unexplored.[12]

18.3.5 DMI Actions in Forest Management and Practices

18.3.5.1 Key Mitigation Principle

1. The *Alberta Trumpeter Swan Recovery Team* is the organization commissioned by the Minister to execute the central role in designing, recommending and coordinating assessment surveys, recovery strategies and industrial practices. This mandate includes developing recommendations on provincial objectives (habitat availability, species persistence)

[12] Northern Alberta has been identified as potentially providing good opportunity for new habitat considering additional unutilized wetland sites deemed suitable for breeding. (Alberta Trumpeter Swan Recovery Plan 2005-2010)

2. Accurate and 'current' spatial delineation of swan habitat locations are fundamental to defining actions and where to commit strategic investment.
3. **Mitigation is largely founded on avoiding sensory disturbance and preserving effective water-feature habitat state.

18.3.5.2 General Actions

DMI has voluntarily established a pro-active internal policy that generally schedules activities to avoid the deployment of felling and skidding operations during the critical nesting period for boreal bird species (3rd week of April to mid-July).[13] Following consultation with federal avifauna-specialist staff, this was formalized in 2006 as a corporate initiative to recognize the significant influx of highly diverse migratory bird species to the mixedwood boreal forest region. This will readily contribute a form of mitigation for Trumpeter Swans.

- Monitoring and research -to-date no 'collaborative' forums exist concerning provincially coordinated Trumpeter Swan monitoring and research activity within the region
- Planning tools and forest practices -regulator-defined guidelines to forest practices for vicinity Trumpeter Swan habitat are well-established. Strategic-scale planning tools are largely non-existent.
- Landscape specific strategies - to-date no 'collaborative' forums exist for corporate participation to co-develop and contribute to the design of specific strategies for landscape-scale habitat availability & habitat conditions to meet provincial objectives for geographic designated swan survey areas.

18.3.5.3 Specific Actions within Identified Swan Habitat

- Strategic:
    - Improved spatial definition of swan breeding/nesting and non-breeding locations (point data clarification) through DMI pursuit of regional SRD biologist assistance (based on established SRD 5-year survey program interval). DMI has identified occurrence of problematic point locations to regional biologist staff.[14]
    - Proposal to internally define management referral boundaries for local geographic 'clusters' of grouped swan observation points (core habitat definition) through DMI pursuit of regional SRD biologist assistance (based on established SRD 5-year survey program). This is a pro-active DMI initiative to implement a referral-zone for planning staff consultation with regional SRD biologist staff during Forest Harvest Plan development:
        1. to provide improved assurance of DMI staff awareness of most-current swan point-data that might lie within such clustered locations year-to-year.
        2. to recognize other 'potentially' suitable habitat within such clustered known-use locations as a distinct possibility of swan occupation year-to-year.

[13] See "Critical Nesting Periods", Procedure, DMI Environmental Management System, 2006
[14] Personal communications (Dave Moyles, Dave Walty); March 2006, July 2006, August 2006, January 2007, February 2007

- Attempted netdown of landbase (200-meter buffer along all point-locations) during delineation of non-contributing and contributing landbase available for harvest sequencing (subject to local point data reliability issue)
- Permanent-class road infrastructure planning to avoid right-of-way placement in near vicinity to any identified traditional nesting wetlands/waterbodies, thereby reducing risk of reduced or abandoned species use of such key habitat. (prevent cumulative traffic sensory disturbance)
- Identified Swan habitat and core habitat areas (clusters) will be included as part of DMI's "*High Conservation Value Forests"* (HCVF) initiative to delineate geographic areas of special biodiversity significance as an internal planning tool.

- Tactical
  - Point-in-time consultation with Area (regional) SRD Biologist staff during Forest Harvest Plan (FHP) development design stages, where identified swan point-locations are noted
  - Establishing no-harvest buffers to protect long-term integrity of identified nesting/breeding wetland or aquatic habitat, as per regulator guidelines.
  - Harvest-block internal retention design to further reduce line-of-sight and increase cover adjacent to swan-habitat waterbody buffers.
  - Operation scheduling to avoid activity and sensory disturbance during the full defined nesting and breeding season (April 1 to Sept 30) adjacent to regulator-identified swan habitat point-locations.
  - Operation scheduling and inter-forest sector activity coordination to reduce events of multiple-entries and repeated direct disturbance of nesting areas during breeding season. (prevent cumulative activities sensory disturbance)
  - Consideration of identified upstream and downstream swan habitat in designing and maintaining proper hydrologic flow-paths across road-infrastructure (planning/engineering and maintenance).

18.4 Species of Special Management Concern

18.4.1 Alberta (SRD) Expectations

Forest Management Plan (landbase description) is to address the assignment of "non-contributing" lands that are to be excluded due to buffers around 'known' wildlife features (establishment of net harvest-available landbase).
Alberta has recently included a list of additional biodiversity features requiring *operational consideration* along with the other traditional species described earlier. They include critical habitat features such as:

- hibernacula, denning and nesting areas for a variety of taxa or species (colonial nesters, Sandhill Cranes, bats, wolverines, raptors)
- breeding sites and hibernacula of species designated from time-to-time as "at-risk" status (endangered, threatened)
- breeding sites and hibernacula of herptile species
- unique features (mineral licks, natural springs and beaver ponds lacking outflow channels).

The Province has prescribed[15] that in the absence of specific corporate strategies/techniques for these values as defined in the strategic *Forest Management Plan* and operational *Forest Harvest Plans*:

i. Specific pre-established precautionary buffer-widths (Harvest Planning & Operating Ground Rules Framework) will otherwise apply to protect distinct biodiversity features listed above (dens, nests, etcetera).

ii. The dimensional prescriptions in those Ground Rules are not to be interpreted as 'minimums' for separate FMP and FHP strategies.

iii. Staff awareness/training in recognition (species, feature), self-reporting mechanism, and mitigation response to unmapped discoveries are cited keys to addressing such features.

18.4.2 Current State of Knowledge (species sensitivities and risks)

- Varies per species, although hibernacula and all breeding associated habitat-features are a commonly known life-cycle aspect of high temporal sensitivity to disturbance for many species.
- SRD Area Biologists have some limited data records on various documented sensitive feature locations observed and reported within the region (FWMIS database).
- Raptor nests -A local informal DMI survey (2005)[16] validated the continued value in buffering unoccupied raptor nests through observed evidence that some raptor species are opportunistic in selection and re-use of existing nest structures. Treed non-harvest buffers provide benefits in sensory disturbance buffering to future nesting birds, thermal relief, and tree-to-tree perch opportunity for fledglings to develop flight skills prior to post-natal dispersal. Canadian research and jurisdictional requirements defining 'effective' buffer-size for raptor nests vary widely by jurisdiction and species. Nesting bird sensitivity to sensory disturbance sources (road proximity) also appears to vary greatly between raptor species, with some local owl species observed nesting immediately adjacent to all-weather roads.

[15] Oct 11, 2007 personal communication with Jamie Bruha, SRD (MDFP FMA "Operating Ground Rules" discussions forum –clarification regarding section 7.7.6 addressing Species of Special Management Concern)
[16] DMI, 2005; "Boreal raptor nests; A field survey of nest preservation and nest occupancy following forest harvest operations"

- Herptile breeding sites and hibernacula - The aquatic habitat value of waterbodies, larger permanent watercourses and their riparian areas for herptile species appear to be well-studied, as are some documented snake hibernacula. Expertise consultations[17] indicate that treed-canopy cover requisites (density) vary by species. Vegetative understory (ground-cover of shrubs, grasses and forb species) is a common need for foraging, cover and temperature-regulation, although density requisites vary. Micro-site moisture is suggested to be important for many of these species, as met through water proximity and riparian vegetative communities or otherwise through dense forest ground-cover, downed-wood debris and leaf litter-layer on upland areas. A number of amphibian species are documented to over-winter in upland leaf-litter, squirrel caches, sandy-soil or riparian-soil horizon. Distinct water quality attributes are directly related to successful breeding for amphibians. Snake and toad hibernacula appear to represent rather uniquely sensitive features to disturbance, since they are not necessarily associated with water features and can tend to house concentrations of individuals, thereby representing a risk to local sub-population losses if unprotected.
- Bats hibernacula -Bats have been documented to exhibit fidelity to foraging grounds, for which forested ecosystems provide significant habitat structure and trophic sources. Riparian areas also appear to be documented important foraging areas. Research documenting the importance of bat 'roosting' structure (vertical), suggests that variable retention practices can potentially provide the conservation of such features, if trees appropriate for roosting (quality) are retained. Generally, older trees are preferred for roosting sites due directly to decay influence on this vertical structure. In Alberta mixedwood forests, bats appear to prefer old deciduous trees (aspen) for roosting, but have also been observed at high activity within conifer forests. Some limited understanding specific to northern boreal landscape-use has been gained through bat research projects associated with the EMEND research site.[18] These studies seem to suggest that variable-retention practices which create a mosaic of open, thinned and intact patches (different tree densities) are likely to satisfy the behavioral and commuting requirements of a variety of bat species as well as abundance of their prey (insects). A mixture of vertical structure and various stand-closure densities is necessary to meet species-specific requisites that vary between bat species.
- Wolverines -Consultation with expertise[19] indicates much existing wolverine data originates from research in Alberta foothills ecosystems, NWT and B.C., noting also that boreal population habitat requisites may be different. Two habitats appear significant in importance; natural open areas (including open muskeg), and dense older-forest structure (particularly conifer). Historical evidence indicates strong avoidance of anthropogenic open-areas including harvest blocks and linear features, as a probable risk avoidance behavioral strategy. One local long-term monitoring program has recently

[17] Personal Communications 2006+2007; Dr. Brian Eaton, Aquatic Ecologist and herptile specialist, Alberta Research Council and Kris Kendell, Alberta Conservation Association.
[18] Patriquin KJ and Barclay RMR; "Foraging by bats in cleared, thinned and unharvested boreal forest", 2003 + Hogberg LK, Patriquin, Barclay; "Use by bats of patches of residual trees in logged areas of the boreal forest", 2002
[19] Personal Communications 2006; Jason Fisher & Steve Bradbury, Alberta Research Council

noted that wolverine may exhibit adaptive tolerance to some levels of activity and may evidence capacity to re-occupy areas of territory after industrial activities decrease.[20] Habitat-use (foraging and caches) is believed to be similar in scale-size to that of other large carnivores (landscape-scale home ranges).[21] Seasonality sensitivities exist during the mating season (May to August), and the birthing season (February to March), since like other large carnivores, reproductive potential is low. Rearing is supported by den-locations of snow-structure or windthrown trees, with evidence of some fidelity in consecutive years to the same area for future denning sites.

- Colonial Nesters and Sandhill Cranes: In forested landcapes, most of these species tend to rely significantly on wetland features including aquatic and riparian-zone components as core habitat for forage and nesting. Excessive noise and disruption of nesting activities are deemed to be dominant risk factors to breeding success, and are particularly capable of affecting entire sub-populations of individuals that aggregate for breeding at single-locations.[22]

18.4.3 Current Gaps in Knowledge (limiting factors to efficacy of forest landscape management strategies)

- Spatial delineation of known habitat feature locations is generally low
- Landscape-scale modeling tools do not largely exist for most of these species
- Raptors: Beyond sporadic anecdotal information within local agricultural and forest environments, the level of understanding regarding effective buffering size for local raptor species and their response to adjacent human activity is unknown.
- Herptiles: Beyond waterbodies, larger permanent watercourses and some documented snake hibernacula, understanding of the distribution range, critical habitat components, and spatial behavioral patterns of landscape-use is largely understudied or not validated in northwest Alberta for many of the local boreal amphibian and reptile species.[23] The value of ephemeral, intermittent and small-permanent watercourses as well as pocket (vernal) wetland or willow openings is understudied in this region as they might pertain to breeding, drought-relief or over-wintering habitat. Quantified habitat-value distances from water's-edge are also lacking. Vegetative species-community signatures defining optimal habitat are undetermined.
- Bats: Alberta knowledge of distribution, summer/winter habitat requirements, overwintering mechanisms, reproductive nature, movements between seasons, and population trends for all provincial bat species is extremely limited.[24] Despite the

[20] "Year eight: Working towards an understanding of cumulative effects", 2006, Ernst Environmental Services & Pioneer Natural Resources Canada Inc. -(Chinchaga NW Alberta, NE BC)
[21] Status of the Wolverine in Alberta, 1997, Alberta Wildlife Status Report
[22] 2004, "Survey of Colonial Nesting Birds and Lakeshore Habitats in Northeast Alberta", Alberta Species at Risk Report No. 88
[23] Personal Communications 2006-2007 with Dr. Brian Eaton, Aquatic Ecologist and herptile specialist, Alberta Research Council.
[24] 2001, "Survey of the Bats of Central and Northwestern Alberta", Alberta Species at Risk Report No. 4

susceptibility (survival) of hibernating bats to disturbance, known locations of forest hibernacula for over-wintering bat species also appears to be extremely limited. Equally weak is the knowledge of migratory information for the two species of migratory bats in the province. While Northern Long-eared Bats (Myotis septentrionalis) are considered "may-be-at-risk" status in the province, understanding of their density, distribution and critical habitat features is yet rather poor, particularly in northwest Alberta.[25]

- Wolverines: Alberta knowledge of 'boreal' wolverine population distribution, summer/winter habitat requirements, reproductive nature, critical habitat components and spatial behavioral patterns of landscape-use is largely yet forming. Quantified understanding of response to forest harvesting and other anthropogenic disturbance is weak.

18.4.4 DMI Actions in Forest Management and Practices

18.4.4.1 Key Mitigation Principles

1. Accurate definition of core habitat, advance detection of key features, and spatial delineation of sensitive habitat features are fundamental to defining appropriate mitigation actions and where to commit strategic investment.
2. **Mitigation of these particular types of habitat features is largely founded on 'operational' measures (Beneficial Management Practices): response to discovery of unanticipated features, avoiding sensory disturbance, preserving features by screening and buffering.

18.4.4.2 General Actions

The company is involved in a variety of initiatives concerning sensitive species, many of which currently have little regulatory guidelines or formal landscape strategies. Currently, DMI is revisiting corporate works completed prior to the 1999 DFMP in order to re-assess the current list of sensitive species in northwest Alberta. Preliminary re-evaluation indicates potentially 148 local species of various sensitivity including at-risk, may-be-at-risk, sensitive, vulnerable, special concern, isolated range, or of otherwise rarity (S1,S2), as determined by various biodiversity conservation forums.[26]

- Education and Awareness: The company has recently published a reference product to provide a consolidated information source of key facts for these species; status, distribution, ecology, habitat requirements, limiting factors, mitigation opportunities (beneficial practices) and knowledge gaps.[27] The pro-active goal of that product is to heighten awareness among the region's forest practitioners and provide a stepping-stone to further multi-disciplinary

[25] Personal Communications January 2006 with Robert M.R. Barclay, University of Calgary
[26] See corporate species list compilation; "DMI Framework for Integrating At-risk, Rare and Sensitive Species Conservation into Forest Management" (September, 2006)
[27] "Species accounts for high-risk flora and fauna in northwest Alberta; A guide to recognition, species issues, and mitigation opportunities", DMI and Fiera Biological Consulting, 2007

collaboration, in an effort to seek improved scientific understanding and prevent additional species from becoming designated "at-risk".

- Monitoring and research to-date few if any collaborative forums exist concerning provincially coordinated research initiatives for most of the sensitive species in the region.
    - Plants and Arthropods: Beyond the species that Alberta has identified as "high value species", DMI has dedicated a significant collaborative effort toward research on primary-producer species (understory vegetation) and species assemblages at foundational levels of the trophic network (arthropod and micro-fauna). While they are frequently overlooked in discussions of high-value species, it is arguable that such biota hold rather critical roles in forest ecosystem function, and are potentially equally sensitive. The company's interest in such active study is to ultimately refine practices that recognize these foundational species groups.
    - Herptiles: DMI has initiated a collaborative study with the Alberta Research Council. This 3-year project will determine the value of ephemeral, intermittent and small-permanent watercourses as well as pocket (vernal) wetland or willow openings, as such features and their riparian zones might pertain to breeding, drought-relief or over-wintering habitat for herptiles in this region. Quantified habitat-value distances from water's-edge will be assessed. Vegetative species-community signatures defining optimal habitat are also under evaluation as a potential visible-indicator for mitigative planning.
- Planning tools and forest practices - to-date few if any collaborative forums exist concerning established action-organizations that work toward development of integrated, well-coordinated planning tools and improved beneficial management practices (BMP's) for many of these species.
- Individual sensitive species strategies - to-date few if any collaborative forums exist for corporate participation to co-develop and contribute to the design of specific strategies for landscape-scale habitat availability & habitat conditions. Provincial objectives are undefined for many of these species.

18.4.4.3 Specific Actions

- Strategic:
    - Sensitive Species Features (general): Identified sensitive species-features will be included as part of DMI's "*High Conservation Value Forests"* (HCVF) initiative to delineate geographic areas of special biodiversity significance as an internal planning tool. This is a dynamic project recognizing the largely growing data and uncertainties surrounding many sensitive northern boreal species.
    - Staff awareness and training in special biodiversity 'features recognition' will be addressed by various means in collaboration with Area Biologist regulator staff and the reference tool DMI has recently published as a consolidated information source on sensitive species in the region.
    - Avifauna: Since 2005 DMI has deployed a voluntarily internal policy that generally schedules activities to avoid the deployment of felling and skidding operations during

the critical nesting period for boreal birds (3rd week of April to mid-July).[28] Following consultation with federal avifauna-specialist staff, this was formalized in 2006 as a pro-active initiative to recognize the significant influx of highly diverse migratory bird species to the mixedwood boreal forest region, along with non-migratory resident species nesting during this same period.

- o Herptiles: Improved spatial definition of "herptile habitat" (clarification of core riparian habitat) through local DMI research (Alberta Research Council, UofA) focusing on lesser order high-frequency watershed features in northwest boreal forests; ephemeral, intermittent, narrow small-permanent watercourses and vernal pools/pocket wetlands. Attempt to determine a vegetative species-community signature for predicting high-probability herptile occurrence among target watershed features. If such a signature is validated, it could serve as a potential visible-indicator for mitigative planning.
- o Herptiles: In time, the development of a formal management strategy for 'downed woody debris' would appear to hold inherent benefits for some species of herptiles.
- o Wolverines: Viable landscape scale strategies are uncertain for this species in view of yet forming research on boreal populations. Deciduous or mixedwood dominated activities occurring in upland areas do not appear to be significant or in conflict with habitat requisites defined from within other natural regions. There may be potential to consider the species' habitat sensitivities during primary infrastructure planning.

- Tactical
  - o Incorporation of pre-identified (known) significant wildlife features and core habitat into variable-retention design strategies during FHP design stage wherever possible.
  - o Raptors: Since 1997 DMI has deployed a voluntarily practice of buffering all raptor nest discoveries including unoccupied nests (30-meter radius).[29] This was formalized by the company in 2006.
  - o Herptiles: While local active research is pending completion, early indications suggest that amphibians (and possibly reptiles) may benefit from riparian vegetative community preservation along 'some' ephemeral, intermittent and spot vernal wetland pocket watershed features (particularly understory ground-cover of shrubs, grasses and forb species). Selective deployment of variable-retention may be one tool to further assist this effort. Blanket deployment of no-harvest treed-buffers on all such features may appear to be unnecessary and would represent a deviation from natural forest dynamics for herptile habitat.
  - o Snake and toad hibernacula discovered during planning activities will be reported to designated Area Biologist staff. These and other documented (known) locations advised by area biologists will be buffered in consultation with those regulator staff.

[28] See "Critical Nesting Periods", Procedure, DMI Environmental Management System, 2006
[29] See "Raptor Nest Retention", Procedure, DMI Environmental Management System, 2006

- o Bat foraging and roosting sites: Variable-retention block design to achieve a mosaic (variety) of open, thinned and intact patches (different tree densities) is desirable. Selective deployment of variable-retention along riparian areas may be another tool to assist this effort, particularly for foraging habitat. Retention of patches of 'old' deciduous and coniferous stems is desirable for maintaining suitable quality roosting structure.
- o Wolverine dens discovered during planning or operational activities will be reported to designated Area Biologist staff. These and other documented (known) locations advised by area biologists will be buffered in consultation with those regulator staff.
- o Colonial Nesters and Sandhill Cranes: Appropriate buffering of documented (known) locations of key wetlands and waterbody features as advised by Area Biologist regulator staff is anticipated to meet the core aquatic and riparian zone requisites that support forage and nesting.

19: Economic Benefits

DMI has a history of seeking, developing, and implementing innovative solutions to maintain economic viability. DMI will continue to seek opportunities to maximize its return from integrated forest operations.

New equipment, processes, and actions will not be limited by the current state of technology and accepted practice at the time of this document. DMI will work co-operatively with all relevant parties to gain approval of new opportunities when they arise.

Specifically, DMI will seek to capitalize on any economic returns that are made possible through specific identifiable actions on the part of DMI. Should DMI exceed minimum government standard in areas of environmental protection that result in measureable ecological goods and services being produced or protected, DMI will seek economic reward through appropriate economic instruments. These may include, but not be limited to instruments as carbon offset sales, mitigation banking, biodiversity credits.

DMI will manage its produced hog fuel from its in-bush chipping operations (or other harvest operations) in a manner that best meets the economic needs of DMI. DMI retains the flexibility to spread debris back to the site, haul it to the pulp mill or other sites for use in green energy production, dispose of it, or use it for new purposes. The debris management decision will be made at the block level by DMI on an annual basis.

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20: Aboriginal Engagement Summary

Alberta has a legal duty to consult with First Nations on activities that could adversely affect First Nation's Rights and traditional uses of Alberta Crown lands[30]. With regard to consultation on the forest industry activities, the Government of Alberta identified that the General Development Plans (GDPs) and Detailed Forest Management Plans (DFMPs) required consultation with First Nations and delegated this responsibility to the Forest Industry, though Alberta maintained control over the process and the determination for adequacy of consultation.
In the spring of 2007, DMI held one FMA and was responsible for the preparation of a single Detailed Forest Management Plan (DFMP). In 2008, as part of FMA negotiations with Alberta to renew the FMA, ASRD agreed to allow DMI to split the original FMA (FMA8900027) into two FMAs (Westside (FMA0900045) and Eastside (FMA0900044), which resulted in the need for the preparation of two DFMPs. These points are raised to highlight that DMI started its consultation for a single DFMP covering both sides of the Peace River and then shifted consultation to focus on the Eastside FMA and Westside FMA separately when the split became obvious.

20.1 Identification of First Nations for Engagement

While the GOA did not provide a documented listing of First Nations for DMI to consult with on the DFMP and GDP submissions, they revealed no issues with the six First Nations that DMI identified as requiring consultation. For the Westside FMA, Duncan's First Nation and Horse Lake First Nation required consultation, while for the Eastside FMA, consultation was required with Woodland Cree First Nation (WCFN), Lubicon Lake Indian Nation (LUB), Loon River Cree First Nation (LRCFN), and Tall Cree First Nation (TCFN) as shown in the table below.

FMA	*First Nations to Consult*
Westside FMA (0900045)	Duncan's First Nation
	Horse Lake First Nation
Eastside FMA (0900044)	Woodland Cree First Nation
	Lubicon Lake Band
	Loon River Cree First Nation
	Tall Cree First Nation

DMI invested a significant amount of time and resources to consult with the First Nations listed above for the preparation of the DFMP. This effort was in keeping with

[30] Alberta's First Nations Consultation Guidelines on Land Management and Resource Development. 2007.

the objective to develop a plan that considered all of the associated values of the landbase, especially those that respected the treaty and traditional use rights and values of the First Nations people. DMI started early and attempted to work cooperatively with each First Nation to develop processes for engagement that considered the needs of their communities while also aligning with requirements set out in the Alberta Government's First Nations Consultation Policy and Guidelines on Land Management and Resource Development (2007). While all of the First Nations were offered a seat on DMI's Public Advisory Committee (PAC), all declined the offer, preferring instead to individually on a one-on-one approach.
The approach to engage the First Nations regarding the DFMP, to review our methods of forest management and to determine the values and concerns of the First Nations communities was unique with each community but held common underlying obstacles. The primary issues that limited the level of input by First Nations included:

- lack of capacity to understand and comment on our forest management plans,
- economic considerations and impasses on payment for consultation, and
- issues of trust regarding the use of First Nation knowledge (e.g. medicinal plants).

Some of the First Nations embraced the fact that they would now be consulted and while they did not agree with the GOA's process, they were willing to work with it to ensure that their values and concerns were heard. Other First Nations chose not to participate on economic and capacity grounds. In these cases, a review of the values and concerns summarized from all consultation was reviewed with them to ensure that their community's were included in the list prior to the completion of the DFMP.

20.2 Summary of Values and Concerns

Though our engagement of the First Nations took a very different course to that of the Public Advisory Committee, the significant values and concerns of the First Nations have been identified through four years of direct and indirect consultation regarding the DFMP and through other informational avenues such as the annual review of the General Development Plan, field tours, workshops and a variety of discussions and meetings. As shown in Table 35**,** the values are common to the First Nations while in the case of issues and/or concerns, such as their desire for direct consultation with Alberta, there is not complete agreement. While the variability that resulted from the one-on-one approach produced some variability in concerns between communities, the summary taken together provides a comprehensive listing of values and concerns to address.

Table 35. Summary of First Nation Values and/or Concerns identified for the Eastside.

Concern/Value	*Westside FMA*		*Eastside FMA*			
	DFN	*HLFN*	*WCFN*	*LUB*	*LRCFN*	TCFN
Lack of capacity/build capacity to review plans	■	■	■	■	■	■
Participate in land management.		■	■	■	■	■
Want direct consultation with GOA	■	■				
LUF and impacts on DFMP		■	■			■
Support from ASRD for technical capacity	■	■	■			
Discovery of culturally significant sites.	■	■	■	■	■	■
Nests, Dens, Middens, Salt licks, etc.	■	■	■	■	■	■
Reforestation	■		■	■	■	■
Medicinal plants	■		■	■	■	■
Rabbits	■		■		■	■
Squirrel middens	■		■		■	■
Water quality	■		■	■	■	■
Impacts of harvesting on wind, air and water.				■	■	■
Trapping opportunities	■	■	■	■	■	■
Hunting opportunities	■	■	■	■	■	■
Wildlife Populations	■	■	■	■	■	■
Moose	■	■	■	■	■	■
Deer	■	■	■	■	■	■
Caribou	■	■	■		■	■
Access control	■		■	■	■	
Grizzly Bear	■	■	■			
Maintenance of fish populations in lakes.	■		■	■	■	■
Want understanding of forest industry practices	■		■	■	■	
Mountain Pine Beetle and impacts on harvest levels	■	■	■	■		
CBFA status and impacts	■	■	■			■
Support from FMA holders for technical capacity	■	■	■		■	■
Herbicides			■	■	■	■
Integration of ecological and cultural values into DFMP	■	■	■			■
Economic Opportunities	■	■	■	■	■	■
Protect sustainability of traditional and treaty rights	■	■	■	■	■	■
Cummulative effects	■	■	■	■	■	■
Sustainability of forest resources	■	■	■	■	■	■
Quality control of operations	■		■	■	■	■
Protection of culturally significant sites.	■	■	■	■	■	■
Job opportunities	■	■	■	■	■	■

■ Identified concern/issue

20.2.1 Duncan's First Nation

The Duncan's First Nation (DFN) identified that their values were centered on the protection of the sustainability of their traditional use and treaty rights and economic opportunities from activities occurring in their traditional use area and concerns on lack of capacity for consultation and cumulative effects. More recently, the DFN has expressed concerns on the Woodland Caribou and have indicated where they believe the caribou to be today. Concerns and/or issues raised by the DFN included:

- Cumulative effects and effects on wildlife populations
- No capacity to review forestry plans; DFMP or GDP.

- Concerns raised about impacts on medicinal plants, hunting and trapping opportunities, cumulative effects.
- Seeking economic opportunities for the community and their youth.
- Sulphur Lake, Chinchaga and Worsely areas were identified as important and consideration should be given for wildlife buffers.
- Protect Sulphur Lake area from any development.
- Caribou and Grizzly need “no go zones”
- Concerns that areas harvested are not being reforested.
- Desire controlled access for others but open access for DFN
- Elders requested a better understanding of operational practices (OGRs).
- More involvement and consultation with Trappers

20.3 Horse Lake First Nation

The Horse Lake First Nation (HLFN) identified that their values are focused on all aspects the protection of the sustainability of their traditional use and treaty rights and economic opportunities from activities occurring in their traditional use area. Concerns and/or issues raised by the HLFN included:

- Lack of capacity to review plans
- Activities in Caribou and Grizzly ranges
- Cumulative effects
- Prefer direct consultation with GOA
- Increased activities due to MPB
- CBFA and LUF and their integration into DFMPs
- Integration of FN ecological and cultural values into DFMPs
- Support from FMA holders for technical capacity

20.4 Identification of Métis Settlements to Engage

The Paddle Prairie Métis Settlement (PPMS) was identified as an important Aboriginal community to engage for the development of the Westside DFMP, specifically in relation to their proximity to the northern portion of the Westside FMA, previously known as Forest Management Unit P10. Though communication with Métis Settlements is not a provincial requirement, DMI has maintains active communications with PPMS for both the GDP submissions and the DFMP.

20.4.1 Paddle Prairie Métis Settlement

DMI has worked with the Paddle Prairie Métis Settlement since the late 1980's and understood that they would likely have an interest in the DFMP as the Westside FMA is in their vicinity. Following several discussions with them from 2008 to 2010, they indicated that their primary values and concerns surrounding the management of the Westside DFMP were as follows:

- Concerns on potential impact from mill on water quality and fish populations in the Peace River.
- Need for identification and protection of medicinal plant sites.
- Economic opportunities with DMI.
- Reduction of cumulative effects through more integrated approach to management.
- Scarification of conifer blocks limits access.
- The rabbit population decline and MPB are concerns.
- Want to maintain ability to hunt in surrounding area.
- Support for DMI's use of ecosystem-based management approach.
- Concerns on blowdown of conifer retention following deciduous cuts.

20.5 Detailed Report on Communications with Aboriginal Communities

A detailed summary of the communications between DMI , the two First Nations and the Paddle Prairie Métis Settlement has been completed under separate cover and provided to both ASRD and to the Aboriginal Communities.

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21: Public Advisory Committee

DMI has held CSA Z809-02 Sustainable Forest Management Certification since 2008. Meaningful public consultation is a fundamental cornerstone of that certification scheme. DMI has maintained a Public Advisory committee since 2006 that meets the intent of CSA.

The group, composed of municipal government representatives, trappers, members at large have met with DMI 35 times during the development of the management plans for the combined DMI FMAs.

Detailed audit reports and meeting proceedings are available on request.

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22: Reporting & Monitoring

The VOITs are described fully in Section 4:. Each indicator has a reporting periodicity and a work plan to develop reports. Some are annual, some 5 years, some are 10 years.

22.1 Annual Reporting

The indicators requiring an annual report will be summarized in the annual CSA Indicator report. DMI will collate all companies' indicators for that report. The report will be shared with government. Some indicators are routinely reported through other government required annual reporting; for example the GDP. In those cases, the Indicator will be presented multiple times.

DMI uses a compliance audit to prove it is meeting operating ground rules and legislative requirements covering all aspects of its operations and planning. The results of those audits will be used extensively to populate the indicator report.

22.2 Stewardship Report

A Stewardship report will be submitted in September 2014. It will be a 5 year roll-up of all indicators presented in this plan. DMI will collate indicators from all companies. ASRD and DMI will agree to a Terms of Reference for this report no later than September 2013.

22.3 Research

DMI will strive to maintain its commitment to EMEND as a long term efficacy monitoring program to test the EBM strategies employed in this DFMP.



DAISHOWA-MARUBENI INTERNATIONAL LTD.
Peace River Pulp Division

RSA MAI Target Calculations
Detailed Forest Management Plan

FMA 0900045
FMA 0900044
2009-2018

May 11, 2012

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1 Background

DMI produced a DFMP for FMA 8900027 in 2007.

In 2009, FMA8900027 was replaced with two new FMAs – 0900044 & 0900045.

In 2010, RSA came into effect.

In 2012, DMI submitted new DFMPs for both FMAs with an effective date of May 1, 2009.

This document describes the calculation of RSA target MAIs for use in ARIS. Upon acceptance of these targets, DMI will produce detailed block targets.

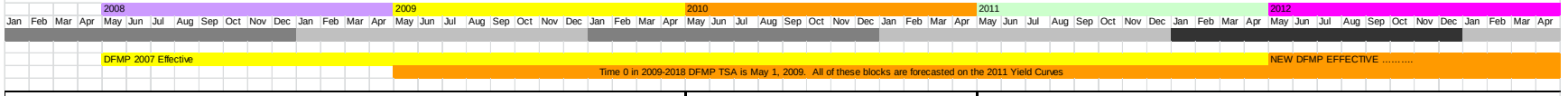
2 Timeline

Discussions with ASRD produced the following plan:

- Create targets for the time period preceeding the 2010 adoption of RSA : (called GROUP A in this submission)
    - Use the yield curves and net land base in effect at that time.
    - Roll targets up to 4 broad cover groups
- Create targets for the time between adoption of RSA in 2010 and the implementation date of the new DFMPs (called GROUP B in this submission)
    - Use the 2011 yield curves and net landbase since the new plan models this time frame
    - Roll targets up to the provincial Base 10.
- Create targets consistent with the new DFMPs for use from date of implementation forward. (called GROUP C in this submission)
    - Use 2011 yield curves

The following summary timeline is found in the attached spreadsheet called "***RSA Timeline.xls***"

RSA MAI TIMELINE



Group A Targets:		Group B Targets:	Group C Targets:
Uses 2002 Yield Curves approved in the 2007 DFMP:	Level 1 in P10 and East Level 2 in P13	Use 2011 yield curves from DFMP 2009-2018	Use 2011 yield curves from DFMP 2009-2018
Uses 2007 net landbase approved in the DFMP		Use 2011 net landbase from DFMP 2009-2018	Use 2011 net landbase from DFMP 2009-2018
Roll Targets up to 4 BCGRPs	D DC CD	Targets are rolled up to ASRD provincial Base 10	Targets are rolled up to DMI 2011 Yield Curves
	CD	Produce targets for East & West FMAs	Produce targets for East & West FMAs
Produce targets for each sustained yield unit used in approved DFMP	P10 P13 East	Targets are area weighted averages based on net forested landbase at start of the management plan	Targets are area weighted averages based on net forested landbase at start of the management plan
Targets are area weighted averages based on net forested landbase at start of the management plan period 1		Culmination age is age at which total volume first peaks	Culmination age is age at which total volume first peaks
Culmination age is age at which total volume first peaks			

3 Targets

3.1 Group A

The Group A MAI targets are found in the spreadsheet called "***Group-A_calculations.xlsx***".

Within are target MAI tables for each of the following sustained yield units from the 2009 DFMP:

- East
- P10
- P13

Each MAI tab is accompanied by a BCG-Area tab that contains the summary data and calculations. Every tab has an explanation text box.

3.2 Group B

The spreadsheet called "***Group-B_YC_map.xls***" contains the tables that map the DMI pathways to the provincial base 10 strata. These are provided for East FMA and West FMA.

The Group B MAI targets are found in the spreadsheet called "***Group-B_calculations.xlsx***".

Within are target MAI tables for each of the following :

- East FMA (tab is called 2009 East MAI)
- West FMA (tab is called 2009 West MAI)

Each MAI tab is accompanied by a *FMP-ASRD-Area Summary* tab that contains the summary data and calculations. Every tab has an explanation text box.

3.3 Group C

The spreadsheet file called "***Group-C_MAI_Calculations.xlsx***" contains the target MAIs for the DMI pathways from east and west FMAs. These values come from the 2011 yield curves and represent MAIs at culmination age where culmination age is defined as the age at which total volume first peaks.

DAISHOWA-MARUBENI INTERNATIONAL LTD.
Peace River Pulp Division

ARIS Reconcile
Detailed Forest Management Plan

FMA 0900045
FMA 0900044
2009-2018

May 11, 2012

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Background

This report is a brief description of a body of work submitted in Excel spreadsheet format. This document is a guide for reviewers looking at the spreadsheets:

FMA0900044_FMP_ARIS_block_reconciliation_summary.xlsx and
FMA0900045_FMP_ARIS_block_reconciliation_summary.xlsx

The data and the results contained within are valid on the date the ARIS records were pulled. It has been determined that the data is in constant flux.

DMI Data Response

The submission is formatted as direct responses to the Regenerating landbase - ARIS records validation procedures document dated December 02, 2009. (attached)

Scope:
The impact of this data when summarized may be overestimated due to existing AVI collected 2003 to 2005 and used in the FMP.

Procedures:
The data for this point by point analysis is contained in the associated ***FMA0900044_FMP_ARIS_block_reconciliation_summary.xlsx*** and ***FMA0900045_FMP_ARIS_block_reconciliation_summary.xlsx*** files.

The tabs in the spreadsheet are named to reflect the numbered point from the letter.

1. Tab 1 – FMP ARIS One to One
    - List of blocks spatially included in the FMP forest which were not linked to ARIS records at the time the FMP forest was created.
    - An FMP AAC m3 reduction has been determined for blocks in this category.
2. Tab 2 – FMP Harv Year > 2008
    - List of blocks spatially included in the FMP forest which were harvested after 2008 and therefore not yet reported to ARIS.
3. Tab 3 – ARIS FMP One to One
    - List of blocks spatially included in the FMP forest which were not linked to ARIS records at the time the FMP forest was created.

4&5. Tab 4 & 5 – FMP ARIS Areas
    - List of FMP forest blocks where the FMP block area is not within the smaller of 5% or +/- 0.5 hectares of the final ARIS area.
    - Rationale for these differences is indicated in the RECORD COMMENT column. Further explained in the associated FMP_ARIS_AreaNonComplianceDescriptions.docx file.
    - An FMP AAC m3 reduction has been determined for blocks in this category.

6. Tab 6 – AGE
    - List of blocks spatially included in the FMP forest, where some portion of the FMP block was assigned an age class not consistent with the ARIS skid clearance year.
7. Tab 7 - FMP YC Standard Modifier YC
    - List of blocks spatially included in the FMP forest, where some portion of the FMP block was assigned to a yield curve not consistent with the ARIS standard modifier.

- 7a), 7b), and 7c) were combined into one comparison based on ARIS standard modifier as the ARIS standard modifier should have changed based on the results of an establishment survey or performance survey.

8. Tab 8 – FMP YC Plant YC
    - List of blocks spatially included in the FMP forest, where some portion of the FMP block was assigned to a yield curve not consistent with the ARIS standard modifier and ARIS planting records.
    - ARIS standard modifier in conjunction with ARIS planting records (%spruce/fir planted, %pine planted, %larch/black spruce planted) were used for this comparison.
    - List of blocks spatially included in the FMP forest, where some portion of the FMP block was assigned to a yield curve not consistent with the ARIS standard modifier, and have an NSR or RTD establishment survey.
    - Blocks in this table are already accounted for in Table 7.
    - This table lists the blocks from Table 7 that have an NSR or RTD Establishment Survey.
9. Tab 9 - FMP YC Stand Mod YC EST NSR
    - List of blocks spatially included in the FMP forest, where some portion of the FMP block was assigned to a yield curve not consistent with the ARIS standard modifier, and have an NSR or RTD establishment survey.
    - Blocks in this table are already accounted for in Table 7.

10a. Tab 10a – NSR Per Surveys
    - List of blocks spatially included in the FMP forest, which have an NSR performance survey with total stocking less than 50%.
    - An FMP AAC m3 reduction has been determined for blocks in this category.

10b1. Tab 10b1 – NSR Per Surveys
    - List of blocks spatially included in the FMP forest, which have an NSR performance survey with total stocking between 50% and 80% where the survey acceptable conifer and deciduous percentage assigned yield curve is not consistent with the FMP assigned yield curve.
    - An FMP AAC m3 reduction has been determined for blocks in this category.

10b2. Tab 10b2 – NSR Per Surveys
    - List of blocks spatially included in the FMP forest, which have an NSR performance survey with total stocking between 50% and 80% where the survey acceptable conifer and deciduous percentage assigned yield curve is consistent with the FMP assigned yield curve.
    - A scaled FMP AAC m3 reduction has been determined for blocks in this category.

11. Does not apply; existing AVI collected 2003 to 2005 and used in the FMP.
12. All known footprint has been removed from the contributing landbase. In cases where old footprint has been reforested (naturally or anthropogenically), existing AVI collected 2003 to 2005 has been used in the FMP.

An FMP AAC Summaries tab has also been included in each of the associated FMP_ARIS_block_reconciliation_summary.xlsx files.

1. Reduction for Table 1 - FMP Blocks not linked to ARIS records
    - No ARIS stakeholder available since FMP blocks not linked to ARIS records at time of FMP forest creation.
    - Many of these have subsequently been linked to the current spatial block layer. This work continues.
2. No summary provided. Simple listing of blocks included in the FMP forest that were harvested after the 2008 timber year and therefore not reported to ARIS.
3. No summary provided. Unable to determine FMP calculated AAC m3 for ARIS records not linked to the FMP forest.

Harvested Area Details

The life cycle of a cut block within DMI's FMA and DTA areas is managed within various spatial data layers. Over the time of active operations in Alberta, DMI has maintained spatial digital representation of the cut blocks within our area of interest. All DMI blocks have been updated within our annual photo update process, which was started in 1989. All quota holder blocks within the FMA have also been updated within the process. Similarly all permit blocks, harvested by small operators, within our FMA were updated if we were made aware of their existence.

The photo update program, like any technology based process, has evolved over time. Improvements in photography resolutions, orthorectification processes and spatial accuracies combined with our ability to create digital features from the photography. In an effort to take advantage of continual advancements in data collection methods and utilization tools DMI has spent countless man hours ensuring the final harvest shapes are as close to what exists in the field as possible.

The forest that has been used with the Forest Management Plan was created from a variety of source data. All data was a snapshot of the data layers at the time of creation. DMI's final block layer has continued to evolve since that date and all corrections to ensure compliance have been made only to the source data. The ARIS data and block data have been synchronized using the source block layer as no changed could be made to the FMP forest post creation. The summary of block non-compliance errors and the explanations are based on the FMP forest block areas and are not on the work that has been done to correct these errors since the creation of the FMP forest.

The non-compliance blocks will fall into one of the following error types:

Blocks where one ARIS record exists for multiple spatial records.

These are permit blocks that were cut adjacent to one another and create a single opening in the forest. A single ARIS record exists for the opening, but DMI maintains the data by individual permit block. At the time the FMP forest was created not all of the contributing permits were attributed to the ARIS opening. This has since been corrected in the source data and if the FMP forest were to be recreated these blocks would no longer be in error.

Blocks harvested under whitezone dispositions with a spatial extent overlapped into the FMA.

These are blocks cut under white zone dispositions where slivers of the harvested area exist within the FMA area. The area of the block is equal to the ARIS net harvested hectare value.

Blocks where the harvested area is outside the FMA.

These are blocks harvested under FMA dispositions where slivers of the harvested area exist outside the FMA area. The area of the block is equal to the ARIS net harvested hectare value.

Blocks that have been spatially adjusted and would comply if the FMP forest were recreated.

These are blocks that have been corrected in the source data since the creation of the FMP forest to ensure ARIS records and the DMI block data are equivalent. They have either been repositioned or re-delineated to match the most current imagery available.

Blocks where the harvested area has been clipped by more recently harvested or planned blocks.

DMI stores block data as individual shapes and overlap from more recent harvesting is allowed to exist. The overlap exists because of the poor spatial resolution of older blocks. These blocks were not corrected spatially at the time because the relative shape and size of the blocks was generally correct. The improved spatial precision of today's data collection methods will prevent the occurrence of this error in the future. However, due to the non-compliance of these blocks in the FMP forest, they been corrected in the source data and if the FMP forest were to be recreated these blocks would no longer be in error.

Blocks where the ARIS net harvested area has not been populated.

These are blocks where the net harvest ha field in ARIS has not yet been populated. This is in the process of correction.

Blocks that have been spatially adjusted since last submitted to ARIS.

These are blocks where spatial correction was made prior to the creation of the FMP forest but their corresponding ARIS records have not yet been updated to reflect these changes. This is in the process of correction.