

## Treatable Area Project Methods

The focus of the ‘Treatable Area Project’ is on:

- X. Mountain Pine Beetle (MPB) impacted mature (60+ years) pine
- Y. MPB impacted immature (<60 years) pine
- Z. Wildfire impacted areas since 1999

The methods described below explain how the numbers were derived

### X. MPB impacted mature area

The focus here is on mature (60+ years of age) pine dominated stands (>50% pine) where the cumulative impact from the MPB was trace (T), low (L), moderate (M), severe (S) or very severe (VS).

1. Total MPB impacted area: refers to all mature pine stands (including those with less than 50% pine) with Trace to Very Severe cumulative impacts and was derived from BCMPBv9
2. THLB area impacted to some extent (T-VS): refers to all mature pine stands with Trace to Very Severe impacts in the Timber Harvesting Land Base (THLB) and was derived from BCMPBv9
3. THLB area impacted with >50% pine: refers to all mature pine dominated stands (>50% pine) with Trace to Very Severe impacts in the THLB and was derived by overlaying the BCMPBv9 cumulative impacts<sup>1</sup>(T, L, M, S, VS) with the most currently available mapping of the THLB from FAIB for 21 key MPB impacted Timber Supply Areas (TSAs). (Note: BCMPBv9 uses an earlier version of THLB so the numbers are similar but not the same.)

The 21 TSAs are Arrow, Boundary, Bulkley, Cranbrook, Dawson Creek, Fort St. John, Golden, Invermere, Kamloops, Kootenay Lake, Lakes, Lillooet, Mackenzie, Merritt, Morice, Okanagan, 100 Mile House, Prince George (contains three districts – Prince George, Ft St James and Vanderhoof which were also mapped separately), Quesnel, Robson Valley, Williams Lake. Based on advice from Adrian Walton, Forest Analysis and Inventory Branch (FAIB) Research Landscape Ecologist, 17 TSAs are not expected to be significantly further impacted whereas the epidemic is still on-going in 4 TSAs (Dawson Creek, Fort St John, Mackenzie and Robson Valley). As a consequence the 2024 projected impacts were used for these 4 TSAs exclusively.

4. THLB area with >50% pine with Severe and Very Severe Impacts: refers to that portion of #3 above that has Severe and Very Severe impacts.
5. Area not projected to be harvested in #4 above (non-obligation): refers to that portion of #4 that has not currently been harvested or is not expected to be salvage harvested. FAIB’s harvest change detection data was used to determine the area of pine-dominated stands impacted by the MPB that has been currently harvested between 1999 and 2010. Harvested areas are assumed to be reforested due to legal obligations under the *Forest and Range Practices Act*. The methods used to derive projected harvest levels are provided by FAIB.

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<sup>1</sup> Cumulative impacts is the current severity class based on the additive nature of past infestation severity ratings such that several light or moderate severity ratings over the years can lead to a S or VS cumulative rating.

6. Natural recovery not expected: refers to that portion of #5 where naturally recovery is not expected within a reasonable time period (approximately 20 – 25 years). ‘Natural recovery’ was assessed by biogeoclimatic zone considering silviculture data. Biogeoclimatic ecosystem classification (BEC) mapping was used to determine the area of harvest and non-harvest by BEC zone. Natural recovery was assessed for the un-harvested area considering stocking levels and secondary structure.

Data from 3823 plots in mature >50% pine stands impacted by the MPB across the province was compiled by Dave Coates and Don Sachs in a report entitled *MPB Impacted Stands Assessment Project – Current State of Knowledge Regarding Secondary Structure: Draft Progress Report to May 2011*. For this treatable area project, the number of plots with 1600+ stems/ha was assumed to be sufficiently stocked, and plots with 10+ cubic metres basal area was assumed to have sufficient secondary structure to contribute to mid-term timber supply. The total number of plots that met those criteria were compared with the total plots by BEC to arrive at percent of plots with predicted natural recovery. A ‘+/- 5%’ range of predicted natural recovery was then used for BEC units with more than 200 total plots, and ‘+/- 10%’ used for those BEC units with fewer plots.

7. Economically treatable area (considering site index, slope & distance to mills): refers to that portion of #6 where for (a) site index (SI) >18, slopes < 30%, and the cycle time to nearest mill <4 hours; and for (b) SI >18 and slopes <30% (i.e. distance to mills not considered).

#### **Y. MPB impacted immature (<60 years) pine**

9. THLB area impacted to some extent (T to VS): is based on findings from Maclauchlan and Brooks’ 2008 *Determining impacts and susceptibility of young pine stands to the MPB* where they indicate that 25% of stands 20-55 years old in 10 districts are impacted. Maclauchlan and Brooks later estimated in 2010 that there about 2 MM ha of pine between 20 and 55 years of age. Therefore if there 25% impact estimate is applied provincially, the estimate is 500 000 ha.

10. THLB area impacted with >50% pine: is derived by overlaying the BCMPBv9 cumulative impacts (T, L, M, S, VS) with the most currently available mapping of the THLB from FAIB for 21 key MPB impacted Timber Supply Areas (TSAs) – similar to #3 above.

11. THLB area with >50% pine with Severe and Very Severe impacts: refers to that portion of #10 that has experience cumulative impacts of Severe to Very Severe.

12. Natural recovery not expected: is the same as #11 because there is no readily available data on the naturally recovery of impacted immature pine-dominated stands as there is with the mature stands. This uncertainty represents an unquantified over-estimation of potentially treatable area.

13. Economically treatable area (considering site index, slope & distance to mills): refers to that portion of #12 where for (a) site index (SI) >18, slopes < 30%, and the cycle time to nearest mill <4 hours; and for (b) SI >18 and slopes <30% (i.e. distance to mills not considered).

#### **Z. Wildfire impacted areas since 1999**

15. Total wildfire burned area (1999 to 2011): is derived from wildfire data from Protection Branch as well as from change detection mapping.

16. THLB area impacted to some extent: is that portion of #15 that is in the THLB (see #3 regarding THLB layer used). This estimate is for all areas of the province (not just the 21 key MPB impacted TSAs)

17. Overlap with with MPB: is that portion of #16 that has not already been addressed in #6 above due to the MPB. The area does not account for projected future harvest, natural recovery, or the severity of the wildfire impact as this data was not readily available for wildfire impacted areas. As a consequence the estimates represents an unquantified over-estimation of potentially treatable area.

18. Economically treatable area (considering site index, slope & distance to mills): refers to that portion of #17 where for (a) site index (SI) >18, slopes < 30%, and the cycle time to nearest mill <4 hours; and for (b) SI >18 and slopes <30% (i.e. distance to mills not considered).

## **Projected Harvest Methodology and Project Data Sources**

### **Projected Harvest Methodology**

Actual harvested area was determined from the change detection process over the time period of 2000 to 2010. The data was processed using the most recent version of the VRI at 30% and greater pine content and then further netted down to include 50% and greater mature pine across all units (*all severity classes were included*). The most current version of forest health overview survey data (FHOS) was also applied together with the 2010 harvest depletion layer from the change detection database. The latest BC MPB v 9.0 model results were used for Year 9 to determine the year of peak infestation for each unit (see <http://www.for.gov.bc.ca/hre/bcmpb/Year9.htm> Adrian Walton). A 10-year period out from the year of peak attack was used for each unit for the low projected harvest scenario and a 15-year period out from the year of peak attack, but not exceeding the 2024 target date, was used for each unit for the high projected harvest scenario.

While an average shelf-life of 8 to 12 years was considered based on previous bio-physical data and analysis, a number of other unpredictable factors were not assumed in either of these scenarios. No market variables such as supply and demand and changing macro-economic conditions were factored into the projections. As well, any potential future economic constraints such as distance to mill or future road construction were not included in either of these projections since these variables were already considered as part of cycle time and site productivity considerations (see Point 8 above).

The year of death derived spatial area estimate of the current harvest is approximately 1.0 MM ha (1,014,998) ha which still falls within the range of prediction of 1.0 to 1.3 million hectares from 1999 to 2009 in the June 13, 2011 draft report *Impact of the Mountain Pine Beetle Infestation on British Columbia's Forests*, Albert Nussbaum. Projected 50% plus mature pine leading harvest for the low and high scenarios is approximately 620,000 ha (622,874) and 1.1 MM ha (1,127,681 ha) respectively compared to the current 50% plus mature pine leading harvest estimate of approximately 1.0 MM ha. Thus, the combined current and projected future harvest total for pine leading stands from 2000 to 2024 inclusive is estimated to range from approximately 1,620,000 to 2.1 MM ha.

## **Data Sources and GIS Process Used for the NSR MPB Analysis**

### **VRI**

*Description:*

FOREST VEGETATION COMPOSITE POLYGONS: An instantiated table joining VEG\_COMP\_POLY and VEG\_COMP\_LYR\_L1\_VW on FEATURE\_ID. This SDE layer coverage contains vegetation cover from the Ministry of Forests. Attribute information is also maintained in this table. It will supersede F\_FC. Vegetation Cover is comprised of spatial layers for the collection, manipulation and production of forest inventory data, which has accompanying textual attributes. This joined table was created to support the Data Distribution Services on the LRDW.

*Data Source:*

LRDW:\\ WHSE\_FOREST\_VEGETATION.VEG\_COMP\_LYR\_R1\_POLY

**THLB**

*Description:*

The timber harvesting land base (THLB) is defined as Crown forest land within the timber supply area where timber harvesting is considered both acceptable and economically feasible, given objectives for all relevant forest values, existing timber quality, market values and applicable technology. The THLB determined by the net down process, in which areas ineligible for harvest are sequentially removed from the total land base. The geodatabase (Consolidated\_THLB.gdb) contains separate datasets for the three Forest Regions (RCO,RNI, RSI), which are each an amalgamation of the data from their individual TSAs.

*Data Source:*

Marble:\\archive\FOR\VIC\HTS\FAIB\_DATA\_FOR\_DISTRIBUTION\THLB\Consolidated\_THLB.gdb

**Harvesting**

*Description:*

The consolidated harvesting dataset comes from a variety of data sources. These include:

- FTEN - Forest Tenures (eg. Cut Blocks)
- Landsat – Harvest change detection from satellite imagery
- VRI – Forest Vegetation Composite polygons
- Results – Silviculture obligations tracked through: Openings, Disturbances, Silviculture activities and Obligation declarations from the Reporting Silviculture Updates and Land status Tracking System

*Data Source:*

Marble:\\archive\FOR\VIC\HTS\FAIB\_DATA\_FOR\_DISTRIBUTION\Cutblocks\Consolidated\_Cutblocks\_2011.gdb

**MPB**

*Description:*

Grids of Cumulative mortality of pine from 1999 to 2011. Based on the Annual Severity grids and volume of pine grid as developed for the BCMPB projection model (version 9).

*Data Source:*

<ftp://ftp.for.gov.bc.ca/HRE/external/!publish/Web/bcmpb/Year9/BCMPB.v9.CumKill.Observed.zip>

## **Slope**

*Description:*

The slope of the land as a percentage value was calculated from a 25 metre TIN surface from TRIM.

*Data Source:*

\\slkbg\imagery\dem\slope\trim\_25m\percent\bcalbers\esri\_ascii\_grid

## **Wildfire**

*Description:*

Wildfire data from Protection Branch as well as from change detection mapping. All data was obtained from 1999-2011.

*Data Sources:*

- LRDW\WHSE\_LAND\_AND\_NATURAL\_RESOURCE.PROT\_HISTORICAL\_FIRE\_POLYS\_SP
- Marble:\\archive\FOR\VIC\HTS\FAIB\_DATA\_FOR\_DISTRIBUTION\annual\_large\_scale\_fire\_mapping.zip

## **Site Productivity**

*Description:*

The Provincial Site Productivity layer had been created using the most current and accurate PEM or TEM information. The bio-physical model was used to fill-in any gaps where no PEM or TEM data of any vintage or level of accuracy is available.

*Data Source:*

[ftp://ftp.for.gov.bc.ca/HTS/external/!publish/Provincial\\_Site\\_Productivity\\_Layer\\_March\\_2012/Site\\_Prod\\_Rasters\\_20120330/](ftp://ftp.for.gov.bc.ca/HTS/external/!publish/Provincial_Site_Productivity_Layer_March_2012/Site_Prod_Rasters_20120330/)

## **Cycle Time**

*Description:*

The Cycle Time dataset contains the upper time (in hours) required to transport wood products and/or materials to/from the nearest processing centre.

*Data Source:*

[http://www.for.gov.bc.ca/ftp/hfp/external/!publish/LBIS\\_web/LBIS\\_Fibre\\_Basket\\_Mapping/Expanded\\_Silv\\_Opportunity\\_Data.zip](http://www.for.gov.bc.ca/ftp/hfp/external/!publish/LBIS_web/LBIS_Fibre_Basket_Mapping/Expanded_Silv_Opportunity_Data.zip)

**TSA Boundaries**

*Description:*

The spatial representation for a Timber Supply Area or TSA Supply Block: A Timber Supply Area is a designated area established by the Ministry in order to practice sound, integrated, resource management principles to improve the allowable annual cuts.

*Data Source:*

LRDW:\\ FADM\_TSA

**GIS Processing Methodology**

- First of all, the percentage of pine for each VRI polygon had to be calculated. Then, all polygons with pine composition greater than or equal to 50% were extracted, and overlaid with the TSA boundaries. Separate datasets were then extracted based on the management units from the TSA boundary dataset.
- For the THLB, all values greater than .1 (10%) were extracted, and overlaid with the TSA boundaries. Then, separate datasets were created based on the management units.
- The harvesting dataset was downloaded from Marble drive, and was flattened so that the latest year of harvesting took precedence (2010 data overwrote 2009 and prior data and so forth). This was accomplished using the “Erase” and “Merge” commands in ArcCatalog.
- With the MPB datasets, the “Grids of Cumulative mortality of pine from 1999 to 2011” dataset was used. ASCII grid datasets were converted to polygonal data, and the grid values were divided by a factor of ten to obtain a percentage. The polygonal data was then assigned a severity from the percentages, from the following lookup table:

Severity	Grid Code
Trace	<1
Light	1-10
Moderate	11-30
Severe	31-50

Very Severe	>50
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- The Slope dataset was assembled from NTS 1:250,000 ESRI ASCII grid files. The raster datasets were converted to polygonal datasets, merged together, and then clipped to each management unit's boundary.
- Wildfire data was amalgamated from LRDW data and Change update mapping. The data was filtered from 1999-2011 and was then flattened in chronological order with the latest taking precedence.
- Site productivity/index was assembled using the latest 2012 datasets of:
  - Pa
  - Pl
  - Pw
  - Py

The four datasets were amalgamated where they existed, and the largest value was used. Where there was an absence of data from the Site Prod dataset, the Site Index from the VRI dataset was used. Pine species were used as the site index species for these polygons because the main focus of this project was determining impacts of MPB on the landscape. As well, given the ecological characteristics of the majority of these sites pine species are expected to comprise a significant component of the regenerating forest on these areas either through natural or artificial means.

- The Cycle Time dataset was extracted from the geodatabase, and then clipped to each Management Unit. The field of CycleClass contained the travel times to mill with values of 0,2,4,6,8,10,60.
- The final step was to overlay the VRI, THLB, Harvesting, MPB, Slope, Wildfire, Site Prod/Index, and Cycle Time datasets. This was accomplished using an "Identity" command in ArcCatalog, with the VRI dataset being the "Input" dataset so that the other datasets were "clipped" to it.
- The final summaries were performed for each management unit in MS Access, utilizing the Site Prod/Index, Slope, MPB Severity, Cycle Time, Age Class, THLB, Harvesting and Fires from the resultant dataset. The area was calculated to hectares from the geometry default of metres<sup>2</sup>, and a final report was created in MS Excel.