

Overview of Mountain Pine Beetle Related Mapping Products

April 30, 2008

Description

- A series of thematic maps have been produced to support FFT in the identification of areas with high potential for application of FFT activities, also known as the FFT footprint. These maps show MPB impact (attack status and severity) together with other key information.
- These maps are cut to management unit boundaries and consist of information that would be most useful to FFT staff and recipient agreement holders (RAHs) based on feedback received: attack status, attack intensity, pine age, pine density and site productivity.
- Information is provided in an easy-to-use format (Adobe) as well as full GIS datasets that can provide a standardized baseline for other analyses and other business needs. The GIS datasets are available individually on DVD format or via FTP, upon request.
- It is intended that certain information on these maps - small scale salvage and major fires depletions - will be migrated to the corporate data warehouse via the VRIMS and RESULTS update cycle as backlog allows.

Background

- Based on past three years of Federal MPB funded inventory and monitoring work.
- Ongoing updates and refinements to this information will be supported by FFT.
- Inputs include 1:20,000 ortho photos, remote sensing change detection, forest health overview surveys, young pine forest health surveys, red and grey attack mapping (map of the dead), vegetation resource inventory pine mask, small scale salvage and major fires depletions, other harvest depletion, and site productivity.
- These data sources are processed as a series of themes or overlays and this process is documented for end users (see attached MPB Mapping Methodology – Overview).
- Links to other useful data sources have also been provided (see attached List of Spatial Data Sources).
- Initial business drivers have been to define current location and extent of MPB impacts, and MPB volume and value impacts and to spatially define the FFT footprint, i.e. define areas with high potential for follow-up survey and treatment
- This product is intended to provide a consistent information base across impacted units for MPB related decision making.

Potential Uses of This Information

- Provide base datasets for FFT and FIA funded silviculture strategies and provide an overview to guide FFT operations in priority management units.
- Guide other strategic and operational decision making in the Ministry, such as identification of reserve areas or potential areas for future bio-energy “footprint”
- Support collaborative efforts in planning inventory (VRI) activities in concert with other sampling activities on a unit by unit basis.

- Provide value added baseline information for use in combination with non-timber information to assist FREP multiple accounts work and assist other agencies such as Ministry of Environment or the Bureau's strategic land use planning initiatives

Schedule and Next Steps

- Thematic mapping products are being completed by management unit according to agreed to priorities with the first 8 high priority units being completed by May 5, 2008. These units are Quesnel, Prince George TSA (3 Districts), Lakes, 100-Mile, Williams Lake, and Kamloops.
- Other units are being processed in May in the following order: Morice, Okanagan, Merritt, Lillooet, Fort St James, Mackenzie, Invermere, Cranbrook, Kootenay Lake, Dawson Creek, Boundary, and Bulkley.
- Information is being made available in Adobe PDF format to support non-GIS/non-technical end users as well as in full GIS ready coverages which will be delivered directly to end users. Notification of new maps and data or refinements or updates to these products will be provided directly to FFT and RAH end users of the information.
- The MPB attack information is provided based on best known information and data will be updated annually, e.g. SSS and major fires depletions and refinement to the MPB attack mapping.
- Other value added products will be developed as needed, e.g. new thematic outputs, shelf-life volume and value reduction factors, thematic roads/access, tenures, etc.
- On-site support will be provided as required (see list of contacts below).

Contacts

Technical support is available at Caslys Consulting Ltd. at:

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Please provide comments to Ministry of Forests and Range Forest Analysis and Inventory Branch for refinements to these maps:

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MPB Mapping Methodology - Overview

Forests for Tomorrow (FFT) is conducting an analysis in support of identifying the location of areas for follow-up survey and on-the-ground activities. In addition, the results of the project will support operational and strategic level planning activities. As part of this project a series of five thematic maps are being developed for each of the Timber Supply Areas (TSAs) in the province:

- pine stands by age class;
- pine stands by pine density;
- mountain pine beetle (MPB) attack severity;
- MPB attack status; and
- site productivity.

The following sections provide information concerning the methods used to develop the various map layers and related ancillary data that are displayed on the maps.

Thematic Maps

Pine Stands by Age Class

A mask, delineating the current extent of B.C.'s pine forest, was developed by extracting a subset of information from the Vegetation Resource Inventory (VRI). This dataset is subsequently referred to as the pine mask. It consists of VRI polygons having $\geq 30\%$ pine species composition in any component. The dataset, supplied by the Ministry, was used to develop a thematic map of the pine forest stratified by age classes. The steps outlined below detail the process.

1. VRI polygons having $\geq 30\%$ lodgepole pine (Pl and Pli) and/or ponderosa pine (Py) were merged into a single layer to form the pine mask.
2. The Harvesting and Small Scale Salvage datasets were incorporated into the pine mask and were assigned an age of = 0 - the recently harvested age class.
3. The Pine Mask dataset was themed based on the Age Ranges (the [AGE_CLS_CD] field within the dataset) and the MPB Age Class was assigned based on the ranges in Table 1.

Table 1. Pine Age Classes

VRI Age Class	Age Range (yrs)	MPB Age Class
0	0	Recently Harvested
1	1-20	Young Pine
2	21-40	Immature Pine
3	41-60	Mature Pine
4	61-80	
5	81-100	
6	101-120	
7	121-140	
8	141-250	
9	≥ 251	

Pine Stands by Pine Density

The pine mask was themed based on the density of pine within each polygon. Density values were derived from the values in the species composition [SPEC_PCT_#] field(s) within the dataset and grouped according to the three classes in Table 2.

Table 2. Pine Density Classes

SPEC_PCT Range
30-50
51-75
76-100

Mountain Pine Beetle Attack Status

A MPB attack layer – a young grey, old grey and red attack composite - was derived from a variety of datasets as per in the following steps. The resulting derivative map layer represents a snapshot of red and grey attack for the 2007 time period based on a composite of the best data available.

1. Where available, the 2005 Orthophoto MPB Attack Mapping was used as it is considered the most accurate data currently available. The dataset is current to 2005 and therefore original red code values were assumed to have progressed to new grey code values, while original new grey codes will have progressed to old grey values over the two-year time span between 2005 and 2007. The red/grey status of the data was selected using the most severe class in either the original [RED_CODE] or [GREY_CODE] fields to project the data to 2007.

i.e., where [RED_CODE] > [GREY_CODE] = new grey attack

else = old grey attack

where ([SOURCE_1] = ' ' OR [PINE_PCT] >= 30)

2. For areas not covered by the Orthophoto Mapping (including code = N/A), the “Year of Death” pixel-to-VRI polygon mapping indicates the year in which a given stand turned visibly red, and therefore, represents the year of attack. Depending on the year of attack, polygons will remain red or will have progressed to one of the two grey attack statuses based on the following date ranges:
 - a. 2006-2007 = red attack
 - b. 2003-2005 = new grey attack
 - c. 2000-2002 = old grey attack

Mountain Pine Beetle Attack Severity

1. The composite attack status layer was themed by the attack severity attribute. The result is a 2007 new and old grey attack map stratified by the severity classes based on the ranges detailed in Table 3.

Table 3. Attack Severity Classes

RED/GREY_CODE	DESCRIPTION	MPB Severity 2007
V	Very Severe (>50%)	Severe
S	Severe (31-50%)	
M	Moderate (11-30%)	Moderate
L	None to Light (<11%)	Light

- Converted all other values (i.e., N/R, N/A, n) to N/A

- Converted 'T' values to L

Site Productivity Mapping

A seamless site productivity map layer was generated to serve as an indicator of forest health. The data represent a composite of the best information currently available.

1. Where available, PEM ecosystem polygons (*pem_2007v41*) was themed by site index rating based on the divisions in Table 4.

Table 4. Site Productivity Site Index Classes

Site Index
0-5
6-10
11-15
16-20
21-25
>25

*Site Index values are an estimate of site productivity for tree growth (mean tree height in metres at breast height age of 50 years).

2. In areas outside the PEM coverage, the TEM ecosystem polygons (*TEM_BEI_poly.shp*) were themed by site index rating based on the same classes developed for the PEM data. If a TSA is completely covered by a seamless TEM coverage and only partially by PEM coverage, consistency was ensured by using only the TEM.
3. Where neither PEM nor TEM data were available, the provincial BEC polygons (*BEC_v6.shp*) were themed by site index rating based on the SIBEC class ranges.
4. In summary, the dataset hierarchy used to develop the site productivity map layer was:
 - i. PEM
 - ii. TEM
 - iii. BEC (SIBEC)
 - iv. other

Ancillary Map Layers

The following ancillary layers are also displayed on the maps. The information below details how the information was compiled.

Young Pine Attack Mapping

1. 2007 Young Pine Aerial Survey Attack Mapping (Lorraine's Data) was linked to the VRI polygons in the Pine Mask via the [Map] and [Poly ID] fields. These 2007 'Young Pine VRI' polygons were themed by [%Red], [%Grey], and [Total_attack] fields. These data are another indicator of the extent of red and grey attack.
2. The Ground Survey Data (*Yng pine ground surveys all Districts_2007.xls*) were converted to a spatial layer using x, y coordinates in the [GPS] field and each associated VRI polygon in Pine Mask was themed by [Attack_Success].

Harvesting Mapping Data

A single layer representing known harvest locations was generated according to the steps outlined below.

1. The harvest mapping age class (the existing class 0 in the Pine Mask) was updated through the integration of various change detection datasets:
 - a. dxx_final_audit.shp
 - b. TSA_name_00_04.shp (e.g., *quesnel_00_04.shp*)
 - c. TSA_name_04_06.shp (e.g., *quesnel_04_06.shp*)
 - d. available Harvest Change Detection Mapping

*where [Class] field exists, theme features with 'cut' attribute differently than those with 'WTP' – wildlife tree patch attribute.

2. The combined harvest polygons were displayed as a single layer and incorporated with VRI Pine Mask (Age = 0 Harvested areas).
3. The harvest polygons were compared against SPOT imagery (where available) to verify the results.

Small Scale Salvage

The extent of Small Scale Salvage is presented as a single layer based on the data in the following two files:

- a. sss_blocks.shp
 - b. all_dxx.shp (e.g., all_dqu.shp)
1. The combined small scale salvage polygons were displayed as a single layer and incorporated with VRI Pine Mask (Age = 0 Harvested areas).

Fire Mapping Data

1. The extent of fires in the last ten years (1997 and later) was determined by combining all polygonal fire data into a seamless layer. This includes data from the following datasets:
 - a. fires_2001
 - b. fires_2002
 - c. fires_2003
 - d. fires_2004
 - e. fires_2005

- f. fires_2006
- g. firehistory.shp (historical fire mapping >= 1997)
- h. FIRE_MAPPING_COMPLETED_2007_3CONTRACTS.shp (2007 fire outline mapping – convert to polygon)
- i. provfire0109 (ArcInfo provincial fire mapping coverage – display only if verified by SPOT imagery to be post-1997 data)

2. The points in Fire_2006_Point_Oct2006.xls to GIS layer were also displayed.

First Nations Lands

- 1. The Agreement in Principle Lands (*AIP_20040428.shp*) were presented as a cartographic layer.

List of Spatial Data Sources to Aid in FFT planning

Last updated April 30, 2008

Information/ Sources	Notes
FFT Footprint – These layers will be used to help identify potential impacted areas that FFT may be able to treat. The footprint is a snapshot using the best available data, and will be updated over time.	
Link to Remote Sensing website pages - FAIB (updated to Nov. 6/07): http://www.for.gov.bc.ca/hts/rs/ MPB attack/ attack severity mapping: Red/Grey attack - http://www.for.gov.bc.ca/hts/rs/ortho_beetle_detection.html Year of death/ current yr attack mapping - http://www.for.gov.bc.ca/hts/rs/beetle_detection.html Fires (location and extent of large fires >100ha): http://www.for.gov.bc.ca/hts/rs/fire_detection.html http://www.for.gov.bc.ca/hts/rs/harvest_detection.html Link to raw data files: \\marble\archive\for\vic\hts\faib_data_for_distribution Contains: <ul style="list-style-type: none"> • Annual Large-scale Fire Mapping (to 2006) in PGDB (personal geo-database) format and Shape file format • Harvest change detection mapping (based on Landsat Imagery) • MPB attack mapping (2005 red/grey mapping at 20:000 scale + 2007 Landsat red attack mapping, landsat year of death mapping for pine stands). • Small Scale Salvage mapping Maps of the Inventories: http://www.for.gov.bc.ca/hts/maps_inventory.htm	FAIB has an ITQ out for value added services to these products – i.e. age classes for the MPB attack layer. Contract completion expected March 31, 08.

<p>MPB Shelf-life Summary Analysis:</p> <p>Harvest Cycle Mapping:</p> <p>http://www.for.gov.bc.ca/hts/bioenergy/cycle.htm</p> <p>NOTE: raw GIS data for the above may be available directly from District offices</p> <p>Supporting Imagery:</p> <p>http://ilmbwww.gov.bc.ca/bmgs/</p>	
<p>Silviculture Strategies – products may vary depending on the TSA needs/ approach. A standard under development will identify some minimum requirements</p>	
<p>Timber Supply and Habitat Modeling – Contractor usually provides PDF maps to recipients and staff.</p> <p>PEM/ TEM homepage (MOE) - http://www.env.gov.bc.ca/ecology/tem/</p>	<p>FFT will require the output data from these analyses</p>
<p>Probability of Natural Regen</p> <p>Model generated (Arbourtech) at part of Type 2 analysis if lead by FFT -Other tools (DCS)</p>	
<p>Retention areas - I.e. the retention model (Arbourtech)</p>	<p>helpful in determining areas with low likelihood of salvage</p>
<p>Merchantability Measure of stand level economics I.e. Merch Model (Arbourtech)</p>	
<p>First Nations areas of interest/concern</p> <p>Arch branch can provide mapped arch sites protected by the Heritage Act. Consultation with FN is required to address the remainder of the issues/concerns.</p>	<p>Through consultation at Silv Strat meetings</p>
<p>Multiple Accounts (Relevant data sources in addition to the Footprint & Silv Strat data)</p>	
<p>Age classes Immature < 80yrs</p> <p>Veg inventory http://www.lrdw.ca/</p>	<p>Provide specific name of LRDW layer?</p>
<p>Site index – Veg Inventory - http://www.lrdw.ca/ Adusted (SIBEC or SIA) for managed stands – No common source exists. Best to get from most recent timber supply project (Type2, TSR, etc). Does not exist for all TSA's and rarely exists as a stand alone product. Can be created if a site series level ecosystem map is available.</p>	
<p>Roads Digital Road Atlas - The Digital Road Atlas (DRA) program exists to provide a single,</p>	

<p>authoritative source of road data for the Province. http://ilmbwww.gov.bc.ca/bmgs/products/mapdata/digital_road_atlas_products.htm</p> <p>Forest Tenure Roads (FTEN Roads) http://www.lrdw.ca/</p>	
<p>Spaced/ Pruned stands Results data query of past silviculture activities Corporate Reporting Systems (http://apps.for.gov.bc.ca/csrsm/browse.do?cat=160) Data Download Reports - RDD006-Activity Report (Licensee)</p>	<p>Need security privileges</p>
<p>Watersheds CWS and DWS (LRDW) - http://www.lrdw.ca/ BC Community Watersheds</p> <p>Designated Sensitive WS (MOE) – only in Kootenay’s (LRDW – L_Domestic Watersheds-KBLUP) Fisheries Sensitive Watersheds - http://www.env.gov.bc.ca/wld/frpa/fsw/approved.html</p> <p>Corporate WS base - The CWB adds functionality to TRIM 1:20 000 digital topographic base map data for the entire Province of British Columbia in order to provide:</p> <p style="padding-left: 40px;">An intelligent, connected feature-coded stream network essential for GIS analysis and presentation of hydrographic information for use in allocation decisions, planning processes and environmental monitoring; and</p> <p style="padding-left: 40px;">Associated watershed boundaries.</p> <p>http://ilmbwww.gov.bc.ca/bmgs/products/mapdata/corporate_watershed_base_products.htm Accessed through http://www.lrdw.ca/</p> <p>ECA calculations: Uses veg data (updated for disturbance) and watershed boundaries and H60 lines. H60 lines are rarely available and have to be created. ECA methodology can be found in Appendix 2 of http://www.for.gov.bc.ca/tasb/legsregs/fpc/FPCGUIDE/wap/WAPGdbk-Web.pdf. NOTE: The "MPB corrected ECA" uses the following ECA factors for MPB disturbed stands (all other disturbances will use the ECA factors provided in the WAP guidebook):</p> <ol style="list-style-type: none"> 1) ECA factor for a recent clearcut = 1.0 2) ECA factor for Pine leading stands (>70% pine)= 0.5 3) ECA factor for mixed pine stands (pine is between 30% and 70% = 0.3 4) ECA factor for all mature stands with less than 30% pine = 0.0 	<p>Regional hydrologists should be consulted</p>
<p>First Nations – areas to be excluded from treatment/ or areas desired for treatments Archaeological Arch branch can provide mapped arch sites protected by the Heritage Act.</p> <p>Consultation with FN is required to address the remainder of the issues/concerns.</p> <p>Areas identified at the Silv Strat table</p>	<p>referrals are still required and may influence site level decisions/prescriptions</p>
<p>Species at Risk Mapped WHA’s: http://www.env.gov.bc.ca/wld/frpa/iwms/wha.html ftp://ribftp.env.gov.bc.ca/pub/outgoing/cdc_data/wha/r4/</p>	
<p>Fire Maintained Ecosystems TEM/ PEM data - http://www.env.gov.bc.ca/ecology/tem/ Local NDT4 restoration plans</p>	
<p>Visually Sensitive Areas</p>	

VQO polygons (ILMB)	
Fire risk/ community safety BC Gazetteer – go to http://ilmbwww.gov.bc.ca/bmgs/products/free.htm to request file Protection Br. Interface areas mapping (Alanya has this on CD)	
Recreation http://www.lrdw.ca/	
Biodiversity (OGMAs) ILMB local office (planning staff); MOE	
Terrestrial wildlife values - DWR, MWR, Caribou, Grizzly UWR Areas: http://www.env.gov.bc.ca/wld/frpa/uwr/approved_uwr.html	
Others – ILMB or Northwest Data Partnership or Kootenay Spatial Partnership	
Aquatic wildlife values – riparian/ fish http://www.env.gov.bc.ca/fish/watershed_atlas_maps/watershed_code/index.html	
Other local datasets where appropriate	