

**Ministry of Forests Lands and Natural Resource Operations
Forest Analysis and Inventory Branch**

**Inventory Section
2015/16 Annual Report**

For the Inventory Section of Forest Analysis and Inventory Branch (FAIB), this document provides:

1. an overview of the inventory section,
2. a reconciliation of what we accomplished in 2015/16 with what we said we'd do in the 2015/16 FAIB Business Plan, and
3. a breakdown of expenditures in 2015/16 by program area.

Inventory Section Annual Reports are posted at <http://www.for.gov.bc.ca/hts/vri/>

1 Section Overview

The inventory section:

- i) collects, manages, and makes available forest inventory information for British Columbia; and
- ii) develops and makes available stand growth and yield models.

The inventory section is the dominant provider (and in many cases the sole provider) of these tools and information in BC.

The section comprises 34 staff located in Victoria, Nanaimo, Nelson, Kamloops, Vancouver, and Campbell River. Our primary products are i) a province-wide forest inventory polygon data set, ii) stand growth and yield models (TASS, TIPSYS, VDYP), and iii) a variety of tree section, ground plot, and photo-plot data sets (PSP, CMI, NFI, NVAF, VRI phase 2, etc). In addition, we acquire and make available several types of imagery (mid-scale and large-scale air photos, and Landsat scenes). We produce and maintain a number of GIS spatial layers including a province-wide site index layer, PSP location layer, and year of MPB mortality layer. Also, we provide a wide variety of reports, custom data summaries, expert review and advice, analyses, model simulations, and protocols and standards.

Our data and models are used to characterize current, and forecast future, forest condition. This information is used in many settings including the analysis of timber supply, evaluation of tenure options and business opportunities, simulation of forest carbon dynamics, silviculture program design, operational planning, state of forest reporting, habitat identification, management of visual resources, wildfire risk assessment, biodiversity and watershed assessment, and much more.

A wide range of public- and private-sector clients utilize our products and services, obtaining them in many ways. Many of our products are accessed and downloaded from our branch web site or FTP site, including the stand growth models, ground sample data summaries, and published reports, protocols and maps. The provincial, forest cover polygon data is provided to users through the DataBC data distribution service. Many users access our forest inventory through software applications such as iMapBC, MapView, and HectaresBC. To service special requests, we provide custom data extracts. Imagery acquired for forest inventory is provided to GeoBC and made available through the GeoBC image distribution web site. Last, in response to user requests, inventory section staff provide expert advice and analyses related to forest inventory, monitoring, and stand growth modelling.

2 Reconciliation of Accomplishments Against Planned Activities

Each year, the FAIB Business Plan lists the projects that the inventory section plans to undertake in the fiscal year. For the period April 1, 2015 to March 31, 2016, the table below lists

- i) what we said we'd do in the 2015/16 FAIB Business Plan, and
- ii) what we actually accomplished in the fiscal year.

The table is focussed on the commitments detailed in section 3.2 of the 2015/16 FAIB Business Plan (available at <http://www.for.gov.bc.ca/hts/vri/>). Some other significant accomplishments, in areas not specified in the business plan, are not included in the table below.

What we said we'd do in the 15/16 branch business plan	What we accomplished in 15/16
<p>Air Photo and Satellite Imagery Acquisition Acquire air photos for the Merritt TSA, Prince George district, and portions of the Cassiar TSA. Acquire DEM and DSM with air photos. Acquire Landsat satellite imagery for the province.</p>	<p>In Merritt TSA and Prince George district, we achieved 100% and 90% of the planned coverage, respectively. Digital color infrared photos with 25 or 30 cm resolution were acquired over 4 million hectares. All imagery was provided to GeoBC for distribution. In the Cassiar, due to prolonged cloud cover we achieved only a portion of the planned acquisition. We acquired DEMs and DSMs derived from the air photos. We acquired and processed 85 individual Landsat 8 satellite scenes covering the province, enhanced the imagery, produced a provincial mosaic, and provided the imagery to the GeoBC image warehouse (http://geobc.gov.bc.ca/base-mapping/imagery/index.html).</p>
<p>Photo-interpretation (VRI Phase 1) Initiate photo-interpretation in southern Fort St James and southern Vancouver Island. Continue photo-</p>	<p>We initiated 2 of the 2 planned photo-interpretation projects. We continued both the Morice and Quesnel projects as planned. We completed the Lakes and Vanderhoof projects as planned. In 2015, photo-interpretation projects totalling 8.7 million hectares</p>

<p>interpretation in Morice and Quesnel TSAs. Complete photo-interpretation projects in Lakes TSA and Vanderhoof district. Prepare implementation plans for Prince George and Merritt.</p>	<p>were underway with project areas as follows: southern Fort St James 1.4M, southern Vancouver Island 1.3M, Morice 1.7M, Quesnel 1.7M, Lakes 1.3M, and Vanderhoof 1.3M hectares. We completed 1 of the 2 implementation plans (Merritt, see http://www.for.gov.bc.ca/hts/vri/planning_reports/tsa_vpip.html). The Prince George plan will be completed in the summer of 2016.</p>
<p>Alternate Approaches to Inventory Mapping (LVI, VRI-fix, VRI-lite) Continue LVI inventory of Cassiar TSA. Complete automated delineation in portions of Tweedsmuir Park. Conduct a LiDAR-based inventory for a project area in Kamloops/Okanagan. Develop options for upgrading existing VRI polygons with LiDAR data. Collaborate with CFS on two projects (TanDEM-X and Landsat time series).</p>	<p>As planned, we continued the LVI-based inventory in Cassiar TSA and are about halfway through this project. We completed automated polygon delineation in Tweedsmuir as part of the Morice photo-interpretation project. We conducted a LiDAR-based inventory for a project area in Kamloops/Okanagan that included measurement of 227 field plots, fitting regression models, and the production of 20m raster map coverage for volume/ha and other attributes for a project area of 317,000 hectares. We developed a method to upgrade existing VRI polygons when LiDAR is available and used this method for an area on northern Vancouver Island. We initiated 1 of 2 planned projects with CFS (Landsat time series). We intend to initiate the TanDEM-X project in 2016.</p>
<p>VRI Ground Sampling (CMI/YSM and VRI phase 2) Co-ordinate the 15/16 ground sampling program. Complete ground sampling in Prince George, 100 Mile House, Kamloops, Okanagan and Lillooet TSAs. Ensure all projects since 2013 have a completed sample plan, archived geospatial data, and completed photo-sample images and photo-estimated attributes. Develop ground sampling plans for 2016.</p>	<p>We co-ordinated a large ground sampling program in 2015 and established 100% of planned samples. We continued to establish monitoring plots on a province-wide 20-km grid. In 2015, samples on the 20-km grid were established over the Kamloops, Okanagan and Lillooet TSAs, expanding coverage to a total of 8 TSAs (22 million hectares). We continued to add to the network of young stand monitoring (YSM) plots. YSM samples were established over the Prince George, 100 Mile House, Kamloops, Okanagan and Lillooet TSAs, expanding coverage to a total of 10 TSAs. An additional 50 ground samples were established in 100 Mile House TSA to increase sample size in the mature stands. We improved archiving but did not complete the retrospective sample plan document as no bids were received on the posted tender. Ground sample implementation plans were developed to guide sampling in 2016. We ran VRI ground sampling certification exams and successfully certified several new contractors. Totals for the year were: 40 photo-samples on the 20-km grid, 92 ground samples on the 20-km grid, 140 additional YSM samples, and 50 VRI phase 2 TEP.</p>

<p>Ground Sample Data Maintenance and Enhancement Load to database and compile all 2015 ground samples. Load some growth plot data from other sources (e.g., backlog PSPs, EPs, etc). Provide ground sample data on request. Produce ground sample data summaries. Complete the design for the new ground sample database and handhelds.</p>	<p>We loaded to the database and compiled all of the 2015 ground samples. Some EPs and PSPs previously measured but not loaded were added to our database. We provided ground sample data on request to a wide range of clients. We produced ground sample data summaries - both written summaries for YSM sampling and excel files by TSA to provide easy access to the entire sample data set (on the FTP site at ftp://ftp.for.gov.bc.ca/HTS/external/!publish/faib_ground_samples). The design for the new ground sample database and handhelds was completed.</p>
<p>NVAF Sampling and Tree Volume Sample 30 NVAF trees in the Kamloops TSA.</p>	<p>We completed 30 NVAF samples in the Kamloops TSA as planned.</p>
<p>Inventory and Monitoring Analysis Co-ordinate inventory and monitoring analyses. Complete inventory and monitoring analysis for Prince George TSA and the Cariboo. Initiate inventory and monitoring analyses for areas sampled in 2015 (Prince George, 100 Mile House, Kamloops, Okanagan and Lillooet TSAs). Apply recent ground sample data and analyses in TSR. Initiate two new types of analysis reports (summary report for PG, regional YSM analysis).</p>	<p>We co-ordinated, and significantly enhanced, our standard inventory and monitoring data analyses. We completed analysis for 1 of the 2 planned areas (Prince George) and posted the analysis report at https://www.for.gov.bc.ca/hts/vri/planning_reports/tsa_analysis.html. Analyses were initiated for 100 Mile House TSA. Ground sample data acquired in 2015 is being applied in the Prince George and Kamloops TSAs. Two new types of analysis reports were initiated – a ground sample summary report for Prince George TSA and a regional YSM analysis. We began to update our set of brief YSM summaries by TSA and will post them to our FTP site when completed.</p>
<p>Site Productivity Update the provincial site index GIS layer. SIBEC sampling in Merritt and Kingcome TSAs. BEC work in Robson Valley, Fraser, and Arrowsmith TSAs. Develop the 2016/17 site productivity work plan.</p>	<p>We updated the provincial site index GIS layer, integrating new data for Kootenay Lake, Arrow, Merritt and Cranbrook TSAs (see http://www.for.gov.bc.ca/hts/siteprod/provlayer.html), and released updated site index layers in HectaresBC (http://hectaresbc.ca/app/habc/HaBC.html). SIBEC sampling in Merritt and Kingcome TSAs, and BEC work in Robson Valley, Fraser, and Arrowsmith TSAs, was completed as planned. We developed a 2016/17 site productivity work plan.</p>
<p>PSP Re-measure 150 PSPs (Cascades, Okanagan-Shuswap, Fort Nelson, and Peace Districts). Refine PSP program planning (short- and long-term). Implement streamlined approach to PSP contracting. Update</p>	<p>We conducted reconnaissance of 362 PSPs and re-measured 150 PSPs in the planned areas. We refined our PSP program planning (short- and long-term). We streamlined our approach to PSP contracting and simplified our contract documents. We updated the PSP measurement standards and procedures documents.</p>

<p>PSP measurement standards and procedures.</p>	
<p>Biometrics Add yield curve plotting capability to VDYP7. Evaluate options for improving VDYP yield predictions for MPB damaged stands. Review or produce yield curves for use in TFL/TSA AAC determination. Apply ground sample data to various components of TSR.</p>	<p>We added yield plotting capabilities to VDYP7 by linking it to the TASS/TIPSY graphing application, PLOTSY. We began evaluating options for improving VDYP yield predictions for MPB damaged stands. We reviewed and produced yield curves for use in TFL/TSA AAC determination. We applied ground sample data to several TSRs, typically via statistical adjustment of VDYP7 yield curves.</p>
<p>Stand Development Modelling Research Release TASS III for lodgepole pine/white spruce mixtures and coastal hemlock/Douglas-fir mixtures. Complete 1st generation RustSim by fall 2015. Remeasure and maintain 21 key GY research installations. Release new versions of TIPSY, FAN\$IER and SITETOOLS. Conduct stand modelling research, including investigations on wood quality, tree mortality, bole increment, and fertilization.</p>	<p>We released a Beta test version of TASS III for lodgepole pine/white spruce mixtures. A first approximation model for coastal hemlock/Douglas-fir mixtures was completed, but further work is required before wide release. We completed the 1st generation RustSim as planned. In partnership with Resource Practices Branch, we re-measured and maintained 21 long-term GY research installations. In addition, we initiated a project to assemble, compile, and report on the ministry's GY experiment data. The new TIPSY V4.3.2 package that includes updates to TIPSY, PLOTSY, FAN\$IER and SiteTools was completed and released (https://www.for.gov.bc.ca/hts/growth/tipsy/tipsy_new_s.html). We completed the planned stand modelling research, prepared and submitted several papers, and delivered presentations at workshops and meetings such as CSC, SISCO, and Western Mensurationists.</p>
<p>Inventory Update, VRIMS Maintenance, and Projection Integrate harvest openings and regeneration updates from RESULTS. Integrate new VRI re inventoried mapsheets. Complete the 2015 projection. Integrate all free-growing data from coastal TSAs. Provide 2015 harvest change detection for the province. Adjust inventory polygon attributes in VRIMS to account for change due to MPB. Adjust inventory polygon attributes in VRIMS to account for all large fires from 2007-2013. Integrate Williams Lake LVI mapsheets into VRIMS prior to 2015</p>	<p>We completed 8 of the 9 planned projects. Approximately 15,000 new harvest and regeneration updates, and 30,000 free growing updates, from RESULTS were processed and brought into the provincial inventory file. This year, 360 full and partial mapsheets (about 5 million hectares) of new VRI inventory were integrated into the provincial inventory data set. The annual projection was significantly delayed due to a special initiative to adjust the attributes of all MPB-affected polygons. The public release of the 2015 provincial inventory file (veg-comp-poly) will occur in June 2016 (available at: http://apps.gov.bc.ca/pub/dwds/home.so). All free-growing data from coastal TSAs was integrated into VRIMS and now all backlog free-growing data has been integrated in the provincial inventory. We</p>

<p>data projection. Update and maintain the consolidated cutblock layer.</p>	<p>completed the 2015 harvest change detection for the province. We adjusted inventory polygon attributes in VRIMS to account for all large fires (366 fires) from 2007-2014 using fire severity classified with Landsat imagery. We integrated 164 Williams Lake LVI mapsheets into VRIMS prior to the 2015 data projection. We updated and maintained the consolidated cutblock layer and began expanding our datasets to include disturbances mapped by the CFS through Landsat time series.</p>
<p>Special Analyses, Initiatives, and Products for Clients Develop a VRI Phase 1 online tutorial and a certification exam, and offer certification opportunity by March 31, 2016. Develop and test new inventory products derived from air photo DEM and DSM. Provide Forestry Canada with updated photos and data when available for NFI photo-plot locations. Develop database and tools for raster format inventory data.</p>	<p>We did not develop a VRI Phase 1 online tutorial (as no bids were received for the posted tender). We developed a certification exam and offered certification opportunities. We began to develop and test new inventory products derived from air photo DEM and DSM; this work will continue into 2016/17. We provided Forestry Canada with updated photos and data for some NFI photo-plot locations. We continued developing a database and tools for raster format inventory data.</p>
<p>Administration of the Forest Inventory and GY Program Plan and manage the inventory and GY program, including program planning, budgeting, progress monitoring and reporting, and stakeholder engagement and communication.</p>	<p>We carefully planned and managed the forest inventory and GY program and the activities of the section as-a-whole. Annual work plans were developed for many program areas (e.g., site productivity and PSPs) and for all major projects. Project progress was monitored throughout the year and summarized in several year-end reports (including this one). We engaged and communicated with stakeholders at the project level, through a series of stakeholder forums, via presentations and our e-newsletter (posted at https://www.for.gov.bc.ca/hts/vri/index.html), and in many other ways.</p>

3. Expenditures in 2015/16 by Program Area

Funding for approximately 98% of the section expenditures was obtained from the Land Based Investment Program. The remainder was provided by base funding and funding from the Canadian Forest Service. The table below provides a breakdown of expenditure by program area.

Program area	Expenditure (\$)	Description
Forest inventory - photo-interpretation	\$5,100,817	Includes air photo acquisition (Merritt TSA, Prince George district and areas in Cassiar TSA) and standard VRI photo interpretation (Morice, Lakes, Vanderhoof, Fort St James, Quesnel, and southern Vancouver Island).
Forest inventory – VRI ground sampling, PSPs, EPs, and analyses	\$943,243	Includes VRI ground sampling (phase 2 5-point clusters, CMI, NFI, and YSM) in Prince George, 100 Mile House, Kamloops, Okanagan, and Lillooet TSAs, NVAF sampling, PSP and EP re-measurement, and analysis of ground sample data.
Site productivity - sampling, mapping, and analyses	\$274,750	Includes SIBEC sampling (Merritt and Kingcome), BEC updates (Robson Valley, Fraser, and Arrowsmith), and update of the provincial site index GIS layer.
Evaluation, development, and application of new inventory methods and technology	\$543,666	Includes LVI (Cassiar), LiDAR (Kamloops/Okanagan) project, CFS Landsat time series, and harvest change detection.
GY model maintenance and development	\$425,613	Includes development of components of TASS III; and enhancements to VDYP, TIPSYP, FAN\$IER, and SiteTools.
Maintenance and enhancement of inventory database and software applications	\$214,905	Includes the annual projection of the forest inventory database, VRIMS maintenance, free-growing updates, and minor software enhancements. Does not include expenditures on the re-design of the ground sample data management system.
Program support	\$343,547	Includes travel, materials and equipment, 3 FTEs, and miscellaneous.
Total	\$7,846,541	