
Vegetation Resources Inventory

Lakes TSA - Project Implementation Plan for Photo Interpretation

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

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Section 1 - Introduction

Background Information

Stakeholders attended a VRI phase 1 planning meeting June 6, 2012 in the Nadina Forest District Office located in Burns Lake for an introduction to the project and to provide input regarding their needs and objectives. Stakeholders for this unit include:

- B.C. Timber Sales
- Nadina District staff
- First Nations
- Local licensees including CanFor, West Fraser, Babine Forest Products, local woodlot owners and community forests.

Significant concerns have been raised regarding the mid-term timber supply given the enormous impact of the mountain pine beetle (MPB) on the pine component in this TSA. Recent uplifts of allowable annual cut (AAC) have occurred in order to expeditiously harvest as much of the beetle killed wood as possible before it exceeds its shelf-life (please see pg 5 in *Lakes TSA Public Discussion Paper*, May, 2010 at http://www.for.gov.bc.ca/hts/tsa/tsa14/current_tsr_2009/14ts10pdp.pdf). The recently formed Special Committee on Timber Supply has also identified Lakes as one of the heavily impacted critical units with very high mortality in all of the mature pine stands. The Special Committee on Timber Supply summarized key messages from a series of local public hearings including the need to base decisions on an updated inventory (please see pgs 12, 14 and 25 in *Special Committee on Timber Supply Report*, August, 2012 at <http://www.leg.bc.ca/cmt/39thparl/session-4/timber/reports/PDF/Rpt-TIMBER-39-4-GrowingFibreGrowingValue-2012-08-15.pdf>). The need for current and accurate forest inventory of the Lakes TSA was identified as a critical information source to inform local decision making.

The present inventory consists of a mix of varying currencies and formats and was adequate for planning and timber supply purposes in a pre-MPB world but is obviously now in need of a re-inventory (please see State of the Current Inventory below). A re-inventory of the TSA would provide up-to-date and accurate information on live and dead volumes, stocking and growth rates to inform the mid-term timber supply. The re-inventory process starts by acquiring new imagery as the old air photos were acquired prior to MPB and subsequent harvest uplifts and activities. The new 2012 digital air photos being acquired this field season will provide full coverage of approximately 1.1 million hectares of the TSA exclusive of parks. This new imagery will be used for photo interpretation of live and dead components of the inventory in concert with air and ground calls for calibration purposes.

Overview of the VRI Process

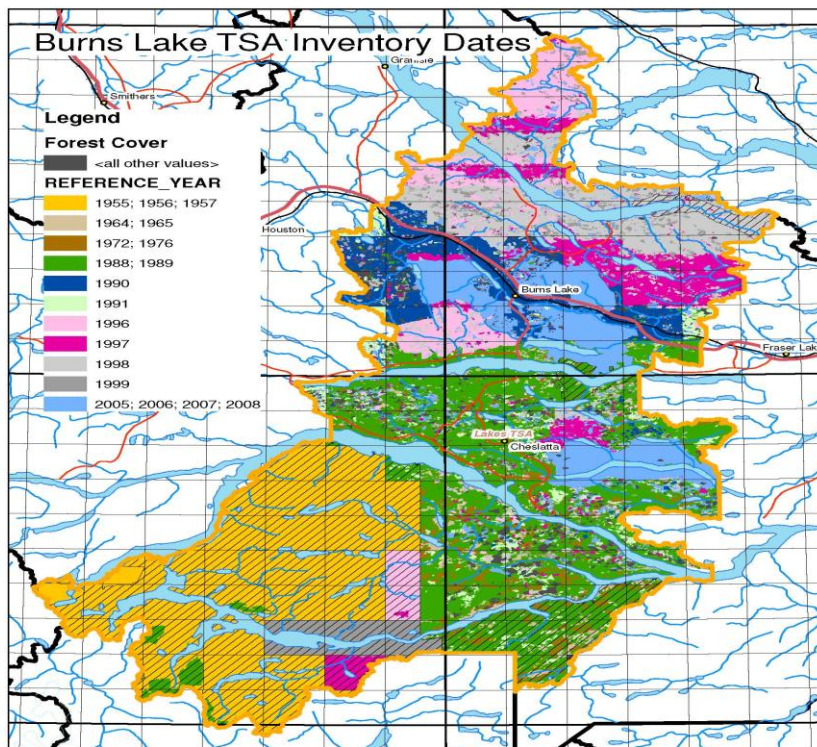
The Vegetation Resources Inventory (VRI) provides a ‘strategic’ level planning inventory at the management unit level (TSA or TFL) designed to answer two basic questions: where is the resource and how much is there. The VRI inventory standard consists of two Phases that may be undertaken in combination or in certain situations, individually. In Phase I of the inventory, air photos are acquired, and polygons are delineated within an inventory unit. Vegetation attributes of these polygons are estimated by photo interpreters. In Phase II of the inventory, a subset of the polygons is randomly selected for ground sampling and Net Volume Adjustment Factor (NVAF) sampling. The purpose of Phase II ground SAMPLING is to verify our level of confidence in the Phase 1 inventory and to provide supplementary information on stand characteristics (such as tree size distribution) that are not captured in Phase 1.

More details regarding the VRI process and the VRI standards and procedures are available at the MFLNRO Forest Analysis and Inventory Branch website: <http://www.for.gov.bc.ca/hts/vri/index.html>

State of the Current Inventory

The forest cover attributes for the majority of the TSA conform to the old Forest Inventory Planning (FIP) standard rather than to the latest VRI standard. The majority of the air photos on which the forest cover inventory is based were acquired in the late 1980s and early 1990s. In Tweedsmuir Park the inventory dates from the 1950s. New photography was acquired for the Burns Lake and Cheslatta Community Forests between 2005 and 2008 and both areas were re-inventoried to the current VRI standard (see Figure 1 below – Burns Lake Inventory Dates).

Fig. 1 – Lakes TSA Inventory Dates



Inventory Plan for Photo Interpretation of the Lakes TSA

Harvest and reforestation updates to the inventory file are current to 2011. Harvest detection mapping based on satellite imagery is current to 2011. Recent fires and free-growing survey results have not been integrated into the inventory file. The inventory file has been projected to 2011 and polygon volumes have been adjusted to reflect MPB mortality observed in the 2010 forest health overview flight.

An inventory analysis was completed in 2008 and VRI Phase 2 ground sample volume exceeded VDYP7 inventory file volume by 10%.

Document Objectives

This inventory planning document is a working document that states the critical reasons and objectives for carrying out a Phase 1 VRI in the Lakes TSA together with details on the area to be inventoried and key steps during the implementation of this Phase 1 inventory project.

This plan identifies the target project area for new photo interpretation within the boundaries of Lakes Timber Supply Area (TSA), including the Vanderhoof TSA adjoining area, and the stages required to be carried out for a successful completion of a photo interpretation project.

The Lakes TSA Landbase

The Lakes timber supply area, in north-central B.C., covers a total of about 1.5 million hectares ranging from Tweedsmuir Provincial Park in the south to Klaytahnkut Lake in the north. About 72 per cent of the land area is managed by the Ministry of Forests, Lands and Natural Resource Operations. Of the total TSA area, 26 percent is not available for timber harvesting purposes because it is reserved for parks, biodiversity and riparian management or because the productivity of the site is too low to support tree crops, leaving about 1.1 million hectares in the THLB (see Table 1 for a summarized breakdown of the TSA and Fig. 2 Lakes Ownership Status). The forest and range resources of the TSA are administered by the Nadina Forest District office located in Burns Lake. The unit also includes the towns of Decker Lake, François Lake, Grassy Plains and Danskin, as well as several First Nations reserves and communities, and these communities are significantly dependent upon forest resources.

Table 1. Lakes TSA Area Summary

Ownership Description	Area(ha)
Other Crown Land	796,111
Community Forest	120,437
Private	78,902
Park	22,976
Woodlots	20,784
Crown Reserves	6,537
Indian Reserve	1,043
UREP	959
Federal reserve	365
Crown Misc Leases	5
Total	1,048,122

Inventory Plan for Photo Interpretation of the Lakes TSA

Forests are mostly lodgepole pine and spruce, with balsam at higher elevations and some small isolated areas of Douglas-fir along the shores of Babine and François lakes (see Table 2 below for a more detailed breakdown of species). The mountain pine beetle infestation in the Lakes area appears to have peaked in 2005 and has killed about 80 per cent of the mature pine trees available for harvesting (Please refer to BCMPB Report at: <http://www.for.gov.bc.ca/ftp/hre/external/!publish/web/bc/mpb/year9/BCMPB.v9.BeetleProjection.Update.pdf>.)

Table 2. Project Area by Species Summary (species profile excludes Tweedsmuir and Entiako parks)

Leading Species	Area (ha)	% of Area
Lodgepole Pine	617418	62.4
Spruce (hybrid)	219920	22.2
Trembling Aspen	68,994	8.1
Subalpine Fir	57,874	5.8
Black Spruce	8,975	0.9
Cottonwood	1,619	0.2
Douglas Fir	3,377	0.3
Paper Birch	288	0.1
	989,605	100

The sub-boreal spruce (SBS) is the dominant BEC zone in the Lakes TSA accounting for approximately 81% followed by the Engelmann spruce – sub-alpine fir BEC zone accounting for a further 17% of the unit (see Table 3 Summary of Area by BEC Zone). In both these BEC zones MPB attack predominates the majority of stands. Recovery of unmanaged stands in the predominant SBS BEC zone is likely problematic in many stands based on preliminary analysis of secondary structure in 444 plots in this BEC zone. MPB-impacted stands in the SBS zone pose the greatest risk for future timber supply. As much as 31% of pine-leading stands may fall below the 6 m² ha⁻¹ threshold in the SBS zone. In terms of BEC zones in the Lakes TSA, the SBS zone which makes up approximately 81% of the Lakes TSA has the greatest proportion of plots with low post-beetle secondary structure basal area (please see *Current State of Knowledge Regarding Secondary Structure in Mountain Pine Beetle Impacted Landscapes – MPB Impacted Stands Assessment Project*, January, 2012, Coates, D and D. Sachs pg 11 at http://www.for.gov.bc.ca/hts/pubs/MPB_Impacted_Stands_Report_January_20_2012.pdf)

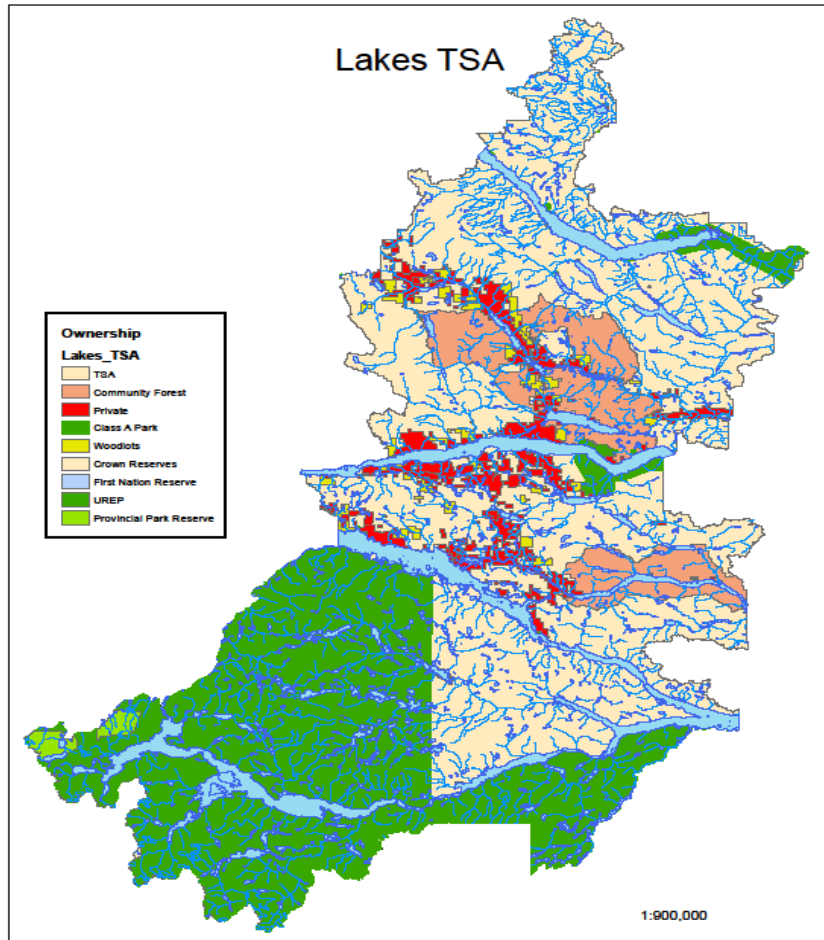
Table 3. Summary of Area by BEC Zone

BEC Zone	ZONE_NAME	Lakes TSA Project Area (ha)	Percent
SBS	Sub-Boreal Spruce	967,639	81
ESSF	Engelmann Spruce -- Subalpine Fir	197,537	17
BAFA - Park	Boreal Altai Fescue Alpine	11,248	1
CWH - Park	Coastal Western Hemlock	10,866	1
MH - Park	Mountain Hemlock	6,155	1
CMA	Coastal Mountain-heather Alpine	960	0
	Total	1,194,405	100

Woodlots and Community Forest

VRI completed during the MPB infestation period is now out of date and will be completely redone. All photo interpretation calibration points established in these projects are available in the new VRI re-inventory digital and spatial format.

Fig. 2 Lakes TSA Ownership Status.



Section 2 - Photo Interpretation Plan

Project Objectives

The overriding objective of this photo interpretation project is to update the Lakes inventory to account for the massive change due to MPB kill since the last inventory. The new inventory will provide current and more accurate information on both live and dead components of the stands for all pine leading and non-pine polygons within the Lakes TSA outside of protected areas. An accurate re-delineation and re-attribution of the MPB killed pine leading stands is required in order to provide information to inform the mid-term TSR analysis in accordance with the direction of the Special Committee on Timber Supply. In addition, significant harvesting has taken place and needs to be reflected in the new inventory.

Please refer to the TSR background information and reports available at:

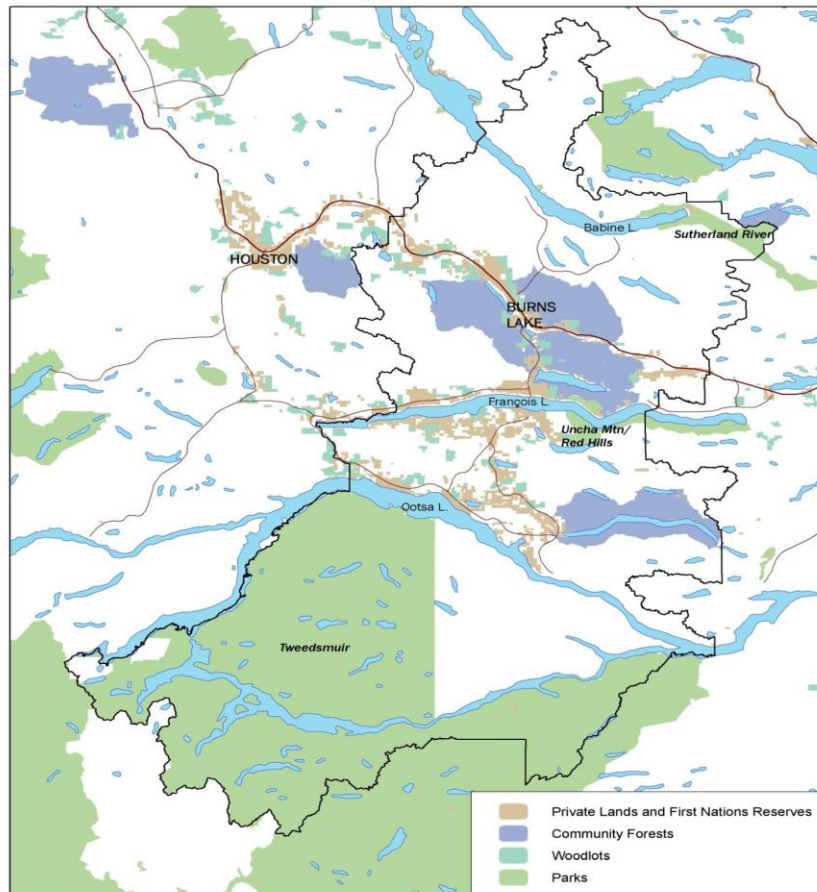
<http://www.for.gov.bc.ca/hts/tsa/tsa14/index.htm>

To provide inventory information immediately, a separate ground sampling project is underway in the Lakes TSA while this plan is being prepared. In the fall of 2012, 96 inventory ground samples are being re-measured. The sample data will provide current, ground-based estimates of live timber volume, dead timber volume, stocking condition, and other timber characteristics. This ground sample will provide reliable inventory information on live/dead volume that the ministry will use to support near-term decision-making while the phase 1 project is underway. While the separate ground sampling project provides volume estimates from 96 samples, the phase 1 project will provide accurate and current spatial information on where this live/dead volume is located across the TSA in conjunction with other forest cover information such as species composition, stocking, age and height.

Target Area

The entire Lakes TSA will be photo interpreted exclusive of protected areas (Tweedsmuir Park, Entiako Park), including woodlots, private land, small parks and community forests (see Fig. 3 Project Area).

Fig. 3 Project Area (excluded protected areas are shaded in green below)



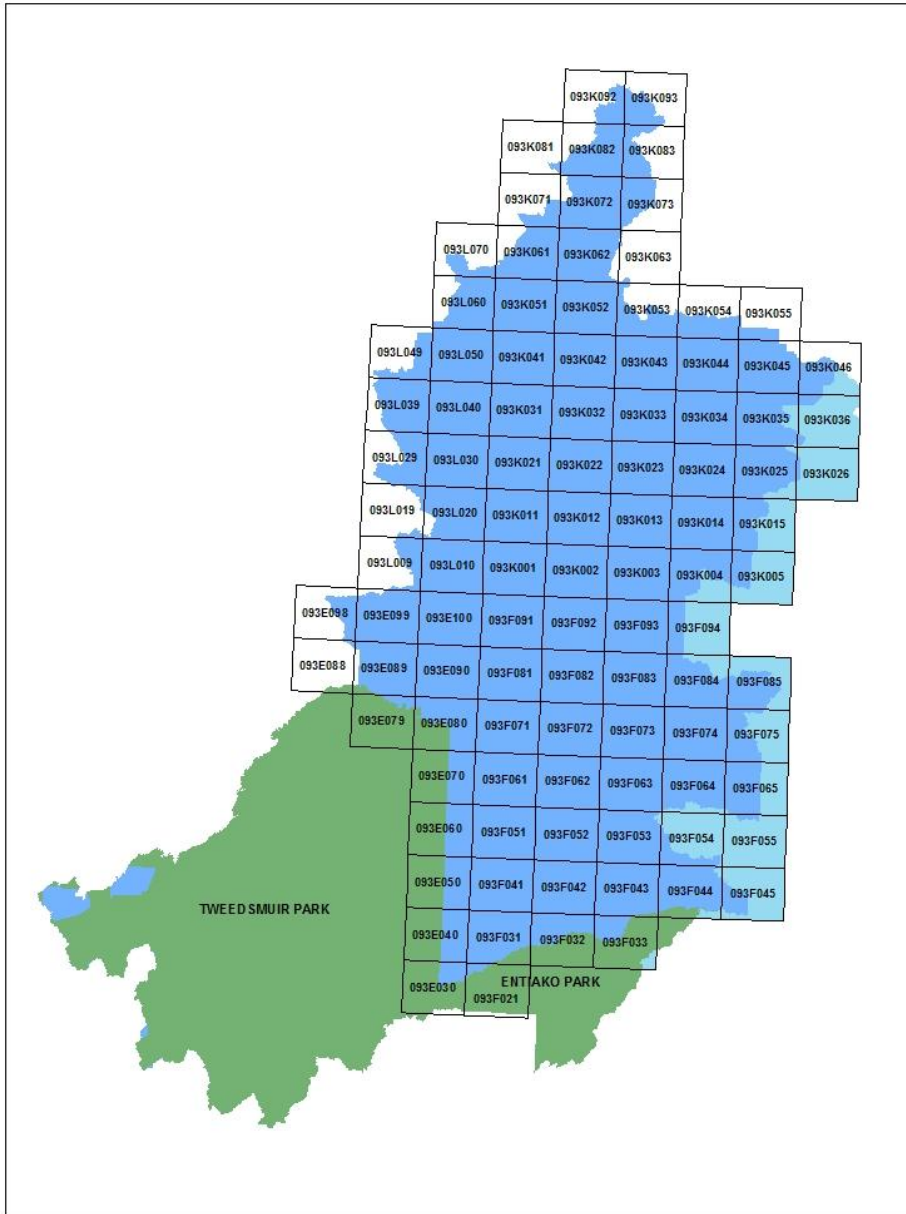
The total Lakes VRI project area is 1,194,411 hectares (approximately 82.5 Full Map Equivalents based on 14,588ha/FME) and encompasses 102 BCGS 1:20000 map sheets. A detail area summary is provided in the attached Appendix A. Note that this includes the addition of approximately 131,138 ha in order to provide complete seamless re-inventory of mapsheets on the adjoining Vanderhoof TSA shown in light blue in Fig. 4 below and is why the total project area is slightly larger than the TSA area tallied in Table 1 on page 3.

Approximately 168,528 hectares, 14% of the total project area, is covered by water.

Re-inventory of the Vanderhoof TSA will be carried out in the same year and all work will tie with the Lakes VRI project. The Ministry will arrange for the exchange of delineation and attribution files with the contractor for the Vanderhoof TSA VRI project.

Inventory Plan for Photo Interpretation of the Lakes TSA

Fig. 4 Lakes VRI Project Map Sheets (area shown in dark blue - Lakes TSA, light blue - Vanderhoof TSA)



Historical Data Sources

An estimate of 4600 formal inventory data sources was established in the Lakes TSA since the first forest inventory project in 1964. An unknown number of the established data sources were destroyed over the years through harvesting and other disturbances. The actual number of data sources still available will be determined at the data source transfer stage which may be completed prior to the award of the VRI photo interpretation contract.

All data sources that were available in the last re-inventory project are documented on the 1989-90 document photos. A digital spatial location of these points is available in ESRI shape file. Data sources available on the document photos will be reviewed by photo interpreters and data sources that are still relevant to a new inventory on the 2012 imagery will be transferred to a digital format provided by the Ministry.

Table 4: Inventory calibration points established in major forest inventory projects in the Lakes TSA.

Year	Air Calls	Ground Calls
1964	400	181
1965	881	623
1975	165	80
1976	324	1111
1991	209	261
1992	164	254
Total	2143	2510

Situations that would justify removal of existing data sources include a major disturbance (such as a large fire, harvesting or insect/disease damage), large stand structure changes, or as defined in the contract document. A large amount of disturbance has occurred in this unit. Thus the intent of this project will be to rely on the more recent information found in the 1991 and 1992 air calls and ground calls rather than on 1976 or older calls. This leaves an estimated total of 373 air calls and 515 ground calls for reference as the most recent historical information (see Table 4 above).

New Data Sources

The contractor will establish a minimum of 10 ground calls and 20 air calls per map FME with the exact ratio of ground to air calls per FME still to be determined.

The ground call types are restricted to 3-point and 1-point. The type of ground call established in each polygon is based on the species complexity as described in the VRI Photo Interpretation Field Calibration Procedures.

To provide reliable calibration data for photo interpretation of the residual live pine component and visible understory, a modified three-point ground calls will be implemented in the field calibration of the MPB impacted stands. The VRI three-point ground call will include 2 measured and 3 count plots to better capture the dead and live stand species composition.

The ratio of 3-pt versus 1-pt ground call will be confirmed after a review of a sample of the 2012 photo images. Any deviation from these numbers must be agreed upon by the Ministry Project Manager and will be reflected in the field calibration plan.

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Current inventory indicates approximately 62% of the project area comprises of pine leading stands. Although pine leading stands traditionally do not require extensive field calibration to achieve reliable photo estimates, a higher than average ground and air calibration program will be required in the MPB stands to ensure reliable determination of live versus dead tree volume component which is a key focus of this inventory.

Prior to the initiation of a field calibration program, a Field Calibration Plan (see Guidelines in Appendix D) is to be submitted to the Ministry Project Manager for approval.

As part of the deliverables, the Ministry requires a complete set of any new data sources be provided in a suitable digital format (as determined by the Ministry), including the geographical locations (UTM coordinates) of these data sources as well as the complete set of field attribute data collected.

A PEM has already been completed for the Lakes TSA together with a number of other site productivity sampling projects of varying vintage. The most recent site productivity data has recently been loaded into a provincial site productivity layer. The most recent PEM passed an accuracy assessment (AA) in accordance with the most recent standards and procedures for this information and is available for use in this project (please see Appendix C).

Other Data Sources

Table 5. Other Data Sources

Data Source Origin	Type	Number of Data Sources
Growth and Yield Permanent Sample Plots (PSP)	PSP	59
Burns Lake Community Forest 2007/08- Ground Calls	XGV	36
Burns Lake Community Forest 2007/08 - Air Calls	XV	194
Cheslatta Community Forest 2008 - Ground Calls	XGV	134
Terrestrial Ecosystem Mapping with tree data	TEM	See below*
Predictive Ecosystem Mapping with tree data Site Productivity Layer (MPB -Site Index)	PEM	See below*

*The VRI Phase 1 contractor will use the provincial site productivity layer information as a reference for site index (SI) where SI cannot be estimated from suitable live mature trees, i.e. in areas of high MPB mortality. This GIS database contains the latest PEM, TEM and SIBEC information for the Lakes TSA by species. The provincial site productivity layer data and supporting information is available at:

<http://www.for.gov.bc.ca/hts/siteprod/provlayer.html>

Polygon Delineation

Polygon delineation is to be completed to VRI standards. Any deviation from these standards must be agreed to by the Ministry Project Manager.

It is critical in the MPB impacted stands to capture the residual live tree component; therefore throughout the delineation process the live trees must guide the line placement and

the resulting polygon boundaries. Photo interpreters will not extrapolate visible understory to adjacent polygons. Only when understory is visible will it be summarized as a separate layer in each polygon.

The intent is to follow the process for delineating and attributing MPB impacted stands now underway in the Kamloops TSA Phase 1 VRI (see Appendix B for details). Any amendment of this process would be based on an assessment of the Kamloops project later in this fiscal.

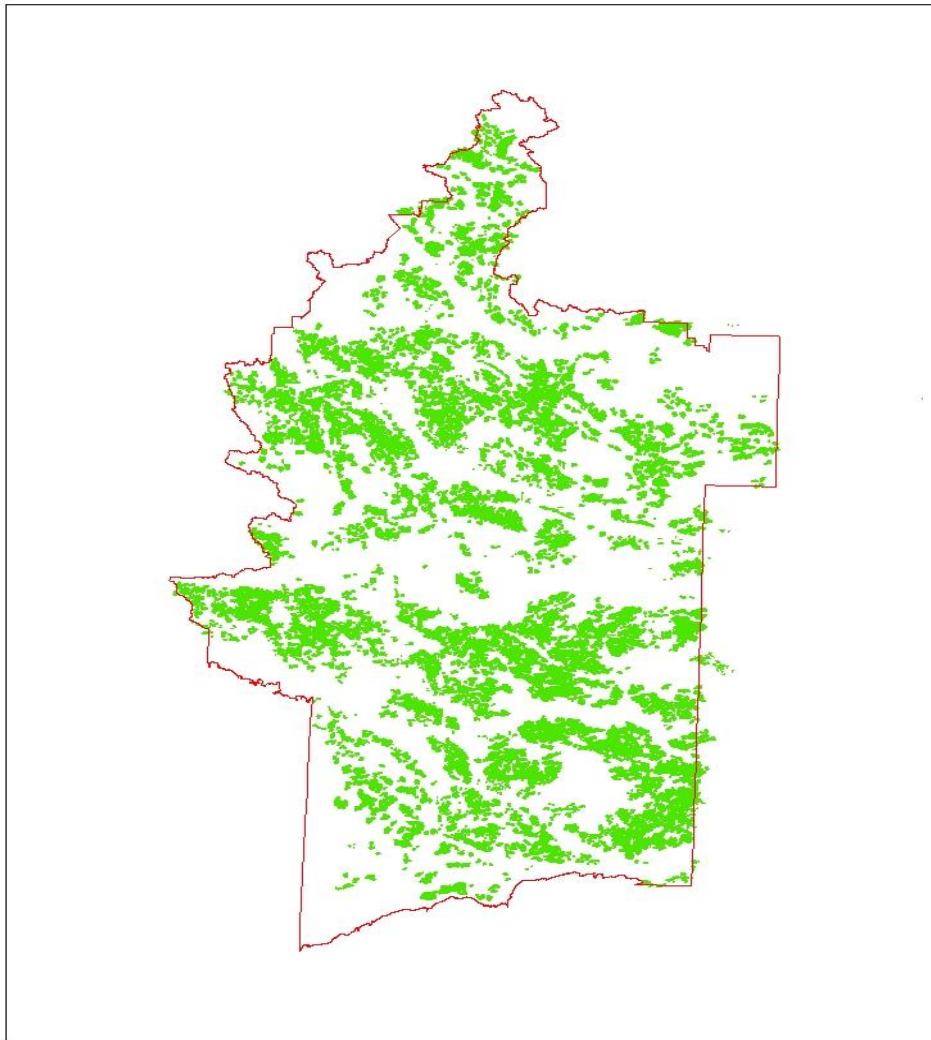
Integrating RESULTS Information

The integration of the RESULTS (Reporting Silviculture Updates and Land status Tracking System) spatial files and tree attribute data will be completed at the delineation and attribution stages of the project.

The RESULTS database indicates approximately 19,950 Opening ID Records that currently exist within the project area. The total spatial area of the openings comprises approximately 17% of the project area (see Fig. 5 below).

An ESRI shape file for the RESULTS openings and tree attributes will be provided to the bidders attending a mandatory project viewing session.

Fig. 5 Lakes project area RESULTS Spatial File Coverage (shown in green) October 2012



There is a review of RESULTS data presently underway and preliminary RESULTS summaries indicate there is missing spatial and attribute data. There are 2046 openings in the Lakes TSA that had opening spatial but no forest cover spatial. Over half of the 2046, 1061 openings, have negative opening ids and are therefore from the old aspatial ISIS/ML SIS corporate database. RESULTS data preparation will need to account for these data gaps and any anomalies in advance of start-up of the photo interpretation work. Any RESULTS data cleanup and rationalization would be conducted through the Nadina District in coordination with the Kamloops update group in advance of project start-up, likely around mid-January, 2013.

Some openings in the air photos won't be found in the RESULTS data cut. Attribution of harvested areas that are not identified in the RESULTS spatial files will be completed in accordance with the procedures for Photo Interpretation Guidelines for Integrating RESULTS Information.

Attribute Estimation

This project will be undertaken in softcopy (digital photogrammetric) format.

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The intent is to follow the process for delineating and attributing MPB impacted stands now underway in the Kamloops TSA Phase 1 VRI (see Appendix B for details). Any amendment of this process would be based on an assessment of the Kamloops project later on this fiscal.

Photogrammetric tree heights will be taken where suitable at the discretion of the photo interpreter. There will be no quality assurance carried out of the photogrammetric heights.

Mapping

The Ministry has developed a format and database standards for the submission and storage of spatial and attribute data for VRI Photo interpretation. All new projects must be completed to this standard and submitted to the Ministry Project Manager following successful QA.

The Contractor will adhere to the most current version of the *VRIMS Personal Geodatabase Structure and Use and VRIMS Vegetation Cover Polygon Validation Rules* published by the Forest Analysis and Inventory Branch.

TRIM Base

A TRIM (NAD 83) format base files will be made available to the contractor at the project pre-work meeting.

There will be no changes made to the TRIM feature unless significant changes occurred to the polygonal features such as lakes and double-line rivers. The contractor must maintain a record of any TRIM changes and submit all changes to the Project Manager in ESRI shape file format. The changes will be passed on to GeoBC for TRIM update.

Section 3 - Project Implementation

Project Pre-work meeting

A project pre-work meeting is mandatory. The purpose of a project pre-work meeting is to bring together the Ministry Project Manager, VRI Phase I contractor, MFLNRO representatives and quality assurance personnel prior to project start-up. This meeting will ensure that an efficient communication network is established, identify individuals responsible for all aspects of the project, allow discussion of any issues before project work commences and establish timelines for deliverables and data flow. Minor changes to the contract to complete the Phase I activities may be identified at this meeting.

A project pre-work checklist, signed off by all parties attending, will be used to organize and guide the meeting.

Scheduling

The project will progress over two fiscal years commencing in the 2013 - 2014 fiscal. Two field seasons will be required for collection of photo interpretation field calibration data.

Approximately two thirds of the photo estimation work will be completed in 2013/14 and the remaining in 2014/15.

A delivery schedule outlining progressive delivery of products will be submitted by the contractor for each fiscal. The format of the delivery schedule will be agreed to at the project pre-work meeting.

Aerial Photography and Photo Scale

The present 2012 digital air photo acquisition is being administered by GeoBC on behalf of FAIB and therefore meets all standards and specifications as summarized below.

Digital frame camera imagery of the project area was acquired to GeoBC photo standards and specifications in the summer of 2012. Flight lines were oriented in an East-West (or opposite) direction and captured at 30cm GSD (ground scale distance). Softcopy image sets will be available as RGBnIr 4 band 8 bit JPEG compressed TIF with a ZI project file. This will allow for natural colour display of imagery as well as colour infrared display using the same image file and softcopy setup.

For projects utilizing digital softcopy photogrammetric technology, the minimum acceptable scale of the imagery shall be 1:20 000 for coastal areas; 1:20 000 for southern interior and central interior areas; and 1:30 000 for portions of the far northern interior. The use of digital imagery requires the use of a Ground Sampling Distance that is compatible to the minimal acceptable scale in hard copy. The Ministry must be consulted in regards to the appropriate photo-scales or Ground Sampling Distance to be implemented on a project. The year(s) of photograph acquisition for the project area must be included and approved as part of the Plan. As a guideline, the maximum age of the photographs is five years from the date of the start of attribute estimation.

Project Manager

The Ministry Project Manager for the Lakes TSA Phase 1 VRI project is Roman Bilek, FAIB. Responsibilities include the following: coordinating the project; monitoring and communicating project progress with the local stakeholders; ensuring all contractors are qualified and certified; overseeing photo-interpretation activities; ensuring quality assurance is complete and delivered at each stage, and assisting in coordinating technical expertise where required.

Personnel

All VRI photo interpretation work must be completed by or directly supervised by a VRI Certified Photo Interpreter. At least 50% of the photo interpreters working on the project must be certified for VRI photo interpretation. All uncertified photo interpreters are to be directly supervised by a Certified Photo Interpreter working on that project.

Quality Assurance

An independent third-party quality assurance (QA) will be completed on all stages of the project in accordance with the VRI Photo Interpretation Quality Assurance Procedures and Standards.

Quality assurance intensity for each stage of the project is to be completed as follows:

Historical Data Source Transfer	5%
Delineation	5%
Field Calibration	5%
Attribution	5%

Quality assurance for digital map production will be conducted by the Province. Contractors will utilize "VEGCAP for Contractors" validation software to perform quality assurance on data files.

All QA findings and re-work instructions are communicated to the VRI contractor by the Ministry Project Manager.

Deliverables

The VRI photo interpretation project deliverables for each stage of the photo interpretation project are outlined in the VRI Photo Interpretation Procedures and VRI Field Calibration Procedures for Photo Interpretation.

For a multi-year project, deliverables are required at the end of each year fiscal. To provide sufficient time for completion of independent third-party quality assurance and Ministry in-house mapping quality assurance, the final deliverables will be submitted at the end of February of each fiscal.

The most current VRI Phase I standards documentation can be accessed from the following NFLNRO web site:

<http://www.for.gov.bc.ca/hts/vri/standards/photo.html>

Submission of all final deliverables will be signed-off by a qualified ABCFP registered Forest Professional.

Roles and Responsibilities

MFLNRO

Project Manager is the point of contact for the Ministry and provides overall communication of project activities with contractors and Nadina District staff and stakeholders via the Ministry SharePoint site.

VRI Contractor

Works with the Ministry Project Manager to ensure the planning, coordination and execution of project activities is consistent with the VPIP and contract requirements.

VRI QA Contractor

Works with the VRI Contractor and Ministry Project Manager to ensure that Quality Assurance reporting meet the VRI prescribed standards.

References for Inventory Standards and Procedures

All work will be carried out in accordance with the following British Columbia Government specifications, current at the time of contract signing.

- *Vegetation Resources Inventory Photo Interpretation Procedures*
- *Vegetation Resources Inventory Photo Interpretation Standards and Quality Assurance Procedures*
- *Vegetation Resources Inventory Field Calibration Procedures for Photo Interpretation*
- *Guideline for Integrating RESULTS Information* (currently contained within the VRI photo interpretation procedures)
- *Vegetation Resources Inventory – The B.C. Land Cover Classification Scheme and addendums*
- *VRIMS Personal Geodatabase Structure and Use*
- *VRIMS Vegetation Cover Polygon Validation Rules*

Inventory Plan for Photo Interpretation of the Lakes TSA

- *Vegetation Resources Inventory Preparing a Project Implementation Plan for Photo interpretation – Appendix D*

Costs

The anticipated cost for completing the project, excluding photo acquisition, but including quality assurance, data capture and field costs based on the level of field calibration to be completed, is 1.2 million dollars. The QA costs are estimated to be between 7% and 10% of the overall photo interpretation project cost for this unit. Note, these estimates are used for project budgeting purposes only, based on current average costs for similar projects.

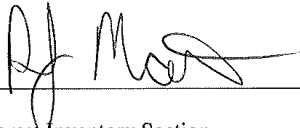
Inventory Plan for Photo Interpretation of the Lakes TSA

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Project Sign-Off Sheet

Lakes Timber Supply Area Vegetation Resources Inventory Photo Interpretation Project Implementation Plan

I have reviewed and approved the Lakes TSA Vegetation Resources Inventory Photo Interpretation Project Implementation Plan.



Nov 30, 2012

Pat Martin
Manager, Forest Inventory Section
Forest Analysis and Inventory Branch
Ministry of Forests, Lands and Natural Resource Operations

Date

Appendix A: Project Map Sheet Area Summary

Map	Full Map Equivalent (hectares)	Project Area (hectares)	Map	Full Map Equivalent Area (hectares)	Project Area (hectares)
093E030	14857	2514	093K011	14546	14546
093E040	14823	6252	093K012	14546	14546
093E050	14788	6234	093K013	14546	14546
093E060	14754	6217	093K014	14546	14546
093E070	14719	6202	093K015	14546	14546
093E079	14685	1338	093K021	14511	14511
093E080	14685	9767	093K022	14511	14511
093E088	14650	229	093K023	14511	14511
093E089	14650	13268	093K024	14511	14511
093E090	14650	14650	093K025	14511	14511
093E098	14615	3776	093K026	14511	14511
093E099	14615	13953	093K031	14476	14476
093E100	14615	14615	093K032	14476	14476
093F021	14857	2055	093K033	14476	14476
093F031	14823	13116	093K034	14476	14476
093F032	14823	7121	093K035	14476	14476
093F033	14823	4451	093K036	14476	14476

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Map	Full Map Equivalent (hectares)	Project Area (hectares)	Map	Full Map Equivalent Area (hectares)	Project Area (hectares)
093F041	14788	14788	093K041	14441	14441
093F042	14788	14788	093K042	14441	14441
093F043	14788	14541	093K043	14441	14441
093F044	14788	13120	093K044	14441	14441
093F045	14788	14733	093K045	14441	13569
093F051	14754	14754	093K046	14441	7679
093F052	14754	14754	093K051	14406	14406
093F053	14754	14754	093K052	14406	14406
093F054	14754	14754	093K053	14406	7914
093F055	14754	14754	093K054	14406	6161
093F061	14719	14719	093K055	14406	2277
093F062	14719	14719	093K061	14371	11231
093F063	14719	14719	093K062	14371	13562
093F064	14719	14719	093K063	14371	333
093F065	14719	14719	093K071	14336	2884
093F071	14685	14685	093K072	14336	13314
093F072	14685	14685	093K073	14336	6128
093F073	14685	14685	093K081	14301	14301
093F074	14685	14685	093K082	14301	10260

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Map	Full Map Equivalent (hectares)	Project Area (hectares)	Map	Full Map Equivalent Area (hectares)	Project Area (hectares)
093F075	14685	14685	093K083	14301	5437
093F081	14650	14650	093K092	14266	3471
093F082	14650	14650	093K093	14266	4524
093F083	14650	14650	093L009	14580	4183
093F084	14650	14650	093L010	14580	14580
093F085	14650	14650	093L019	14546	1658
093F091	14615	14615	093L020	14546	13542
093F092	14615	14615	093L029	14511	8193
093F093	14615	14615	093L030	14511	14511
093F094	14615	14615	093L039	14476	11420
093K001	14580	14580	093L040	14476	14476
093K002	14580	14580	093L049	14441	4695
093K003	14580	14580	093L050	14441	14441
093K004	14580	14580	093L060	14406	10481
093K005	14580	14580	093L070	14371	2832
	Total	623130		Total	571282

Total Project Area(ha) 1,194,411

Appendix B: Delineation and Attribution Process in Mountain Pine Beetle Impacted Stands

The Ministry is interested in collecting more attribute information on stands that have significant amounts of dead standing timber. This will apply to all stands, regardless of species, that the photo interpreters estimate have more than 30% mortality, based on density. In these stands, snags/ ha will be estimated as per the standards and the contractor will create a new “Layer D” and collect the following attributes on the dead standing timber:

- Species composition
- Age of leading
- Height of leading
- Basal area
- Stems/ ha
- Crown closure (estimated as % of stems/ha affected)
- Disturbance type

The main areas that will be included are insect infestation and wildfire. While Mountain Pine Beetle is by far the biggest agent that will affect the need for a dead layer, other agents and factors affecting mortality are included in the dead layer.

The following procedure is proposed where stands have been significantly affected by Mountain Pine Beetle. This is recorded below for information; procedures will be discussed and finalized with the contractor at the pre-work conference.

- In MPB killed stands, where the remaining stand would be classified as Vegetated Treed (VTU or VTW), use normal VRI delineation principles in determining boundaries between polygons, and record snags as appropriate for that polygon.
- In MPB killed stands, where the remaining stand would NOT be classified as Vegetated Treed (VNU or VNW), and WOULD HAVE been classified as Vegetated treed prior to MPB attack, separate polygons based on BCLCS level 5 and snag density. For example a MPB killed stand may now be classified as VNU, HE (or By, ST, SL), and would be delineated to that level, PLUS further delineation based on the number of snags remaining.
- The delineation guideline for snags would be +/- 200 snags per hectare. Basal area will be recorded based on live stems as per current procedures.
- Record the site index for the polygon that most closely approximates the new polygon boundary as the “estimated site index” (average or prorate as appropriate)
- If the polygon is VN but has a treed component (IE 8% crown closure), do not put an estimated site index, it will be calculated using the interpreted age and height, unless the stands is less than 30 years of age.

A significant proportion of the pine in the project area is now dead. In stands where there is approximately a 20% or greater loss in volume, it is appropriate to use live and dead trees for the 6 to

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8 tree ground calibration tally standards. It is also appropriate to use a dead tree as a sample age/height tree in these situations, if a suitable live tree is not available in close proximity.

In affected stands, field data will be taken to determine the species composition post beetle, including understory and residual stands as appropriate.

There are a number of other insect outbreaks occurring in the TSA, if the contractor identifies further large scale outbreaks in areas that are not Pine leading, the above procedures may be extended to other species after discussion and approval by the Ministry project manager.

In polygons that have been heavily impacted by MPB, the field crew will take notes on the species composition, age, height, density of understory if it cannot be seen on the photo. This data will not be sampled and will be an ocular based estimate only. Where understory is visible on the photo, data will be collected as per standards – all layers will be considered. Pre-location of the calibration points prior to fieldwork must take this into account.

The determination on whether the understory can be seen for calibration polygons is a field determination based on the residual main canopy and the height, density and size of the understory,

