Vegetation Resources Inventory

Vanderhoof District

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

The Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) has identified a need to complete a new photo interpreted inventory, VRI Phase 1, in the Vanderhoof Forest District. The plan is to complete this inventory by March 2015. This document details the planning necessary for the project to commence.

The mountain pine beetle (MPB) has significantly affected the forest cover in the Vanderhoof District. The new inventory will provide much needed current information on the spatial distribution of live and dead stands, will update species compositions to reflect MPB mortality, and provide an estimate of the amount of dead volume in the District.

Significant concerns have been raised regarding the mid-term timber supply given the enormous impact of the MPB in this District. 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. 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

Stakeholders attended a VRI phase 1 planning meeting June 5, 2012 in the Vanderhoof Forest District Office for an introduction to the project and to provide input regarding their needs and objectives. Stakeholders at the meeting included:

- Vanderhoof District staff
- B.C. Timber Sales – Stuart Nechako Business Area
- Local licensee representatives from CanFor, and West Fraser

A complete list of attendees is available in Appendix C.

Document Objectives

This Vegetation Resources Inventory Project Implementation Plan (VPIP) is a working document that states the reasons and objectives for carrying out a Phase 1 Vegetation Resources Inventory (VRI) in the Vanderhoof District. It includes details on the area to be inventoried, issues with the current inventory, objectives, and key steps required to be carried out for a successful completion of a photo interpretation project.

Overview of the VRI Process

The Vegetation Resources Inventory (VRI) provides a strategic inventory at the management unit level designed to answer two basic questions: where is the resource, and how much is there? The VRI consists of two Phases: an air photo interpretation stage (Phase 1) and a ground sampling stage (Phase 2). Phase 1 involves the acquisition of new photos, delineation of new polygons, and estimation of polygon attributes with the final product being the corporate inventory. Phase 2 involves sampling a random subset of the new polygons to verify the level of confidence in the Phase 1 and to provide detailed information on tree size and condition that is not available in the 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 current forest cover inventory for the District was finalized in the early 2000's. The majority of the work for the project was completed in 2001 and 2002. It was a VRI retrofit project which involved estimating new VRI attributes on the existing polygon delineation. The polygon delineation was modified in some areas as well but for the most part the delineation was retained from the inventory completed in 1991-1992.

The air photos for the retrofit project were acquired in 2000. The project did not include the mainly agricultural and private land areas that border the Highway 16 corridor.

Harvest and reforestation updates to the inventory 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.

This MPB "kill" in the database is a derived number based on several factors. The model looks at the amount of lodgepole pine (Pl) in each polygon along with information from the 2010 forest health overview flight and the BCMPB kill model. The model reduces the volume of live Pl in the polygon but does not address changes in other attributes such as: species composition, basal area, density, etc.

Two ground sampling projects have been completed since 2001. A VRI Phase 2 project completed in 2002 showed that the inventory attributes and volumes were very close to actual. In 2005 the samples were re-measured to get an estimate of the MPB mortality in the District. The results indicated that more than 50% of the volume in Pl leading stands was dead.

The Vanderhoof District Landbase

The total area within the Vanderhoof Forest District is 1.39 million hectares which represents about 17 percent of the Prince George TSA. Of this area, 1.11 million hectares are considered provincial crown forest land. Table 1 shows the breakdown of the District by ownership class. This also illustrated in Figure 1.

The area is marked by the landscapes of the central interior plateau and the Nechako valley. The lacustrine soils in the valley bottom are fertile agricultural lands while the low-rolling to upland terrain of the plateau is mostly forested with sub-boreal pine and spruce. The largest community in the district is Vanderhoof. First Nations communities include Saikʻuz, Stellatʻen and Nadleh Whutʻen.

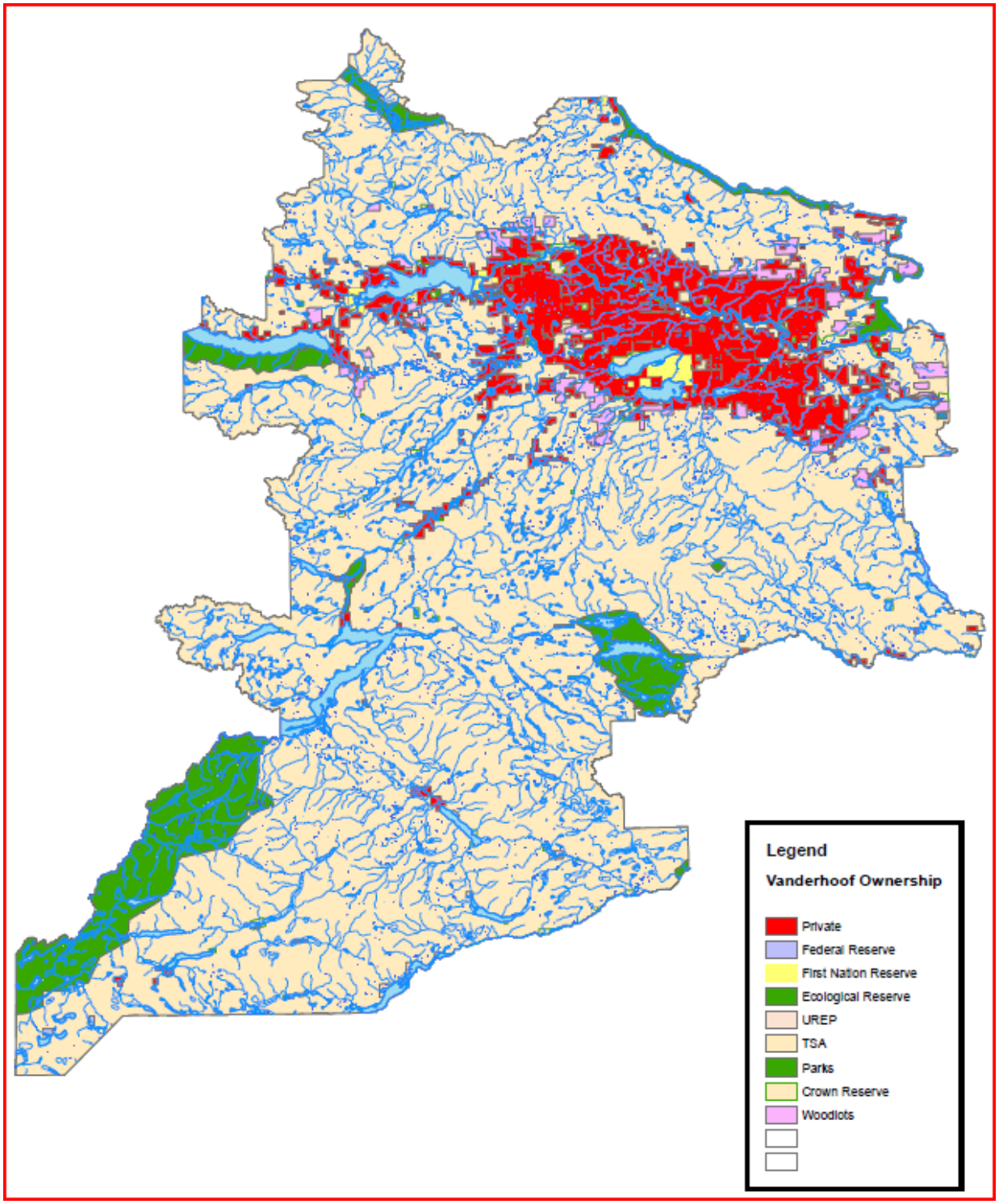
Table 1. Area by ownership designation.

Description	Area (ha)
TSA	1,111,299.5
Private Land	149,296.8
Park	90,904.5
Woodlots	20,510.4
Crown Reserves	7,465.1
First Nation Reserve	5,163.7
Miscellaneous Reserves	3,333.3
Total	1,387,973.3

A history of frequent wildfires helped to maintain a forested state dominated by lodgepole pine which has since succumbed to the mountain pine beetle epidemic. Old forests (> 180 years) are relatively uncommon except for scattered groves of Douglas-fir and the few higher elevation mature Engelmann spruce sub-alpine fir forests. Small patches of trembling aspen, black cottonwood and white birch occur throughout the district.

The sub-boreal spruce (SBS) is the dominant BEC zone in the Vanderhoof District, accounting for approximately 84% of the area followed by the Engelmann spruce – sub-alpine fir (ESSF) zone accounting for a further 11% of the area.

Figure 1. Map of Vanderhoof Forest District



Section 2 - Photo Interpretation Plan

Project Objectives

The overriding objective of this photo interpretation project is to produce a new photo interpreted inventory to account for the massive change due to MPB mortality, and subsequent harvesting, since the last inventory. The new inventory will provide much needed current information on the spatial distribution of live and dead stands, will update species compositions to reflect MPB mortality, and provide an estimate of the amount of dead volume in the District. One of the key outcomes of the project is to acquire improved information on the location of the MPB killed stands and how much residual volume is left in these stands.

Stages of a VRI Phase 1 Project:

Image Acquisition:

- The VRI policy is that images used for VRI photo interpretation projects must be less than five years old. The photos for this project were acquired in the summer of 2012.

Historical Data Source Transfer:

- The existing data sources in the project area are evaluated and captured digitally if they are deemed to be useful for the current project.

Delineation:

- New linework is delineated on the images. Polygon delineation is based on the B.C. Land Cover Classification Scheme. This land classification scheme includes both vegetated and non-vegetated cover classes. Polygons identified by the land classification scheme are further divided into similar vegetated or non-vegetated polygons.

Fieldwork:

- A series of calibration points are established for use by the interpreters. These calibration points are a combination of air calls, done using a helicopter, and ground calls. The calibration program allows the interpreters to get some familiarity with the project area.

Attribute Estimation:

- All delineated polygons are assigned attributes which describe the vegetative or non-vegetative characteristics of the polygon. A complete description of the attributes described is available in the VRI Photo Interpretation Procedures.

Project Area

The entire Vanderhoof Forest District will be inventoried exclusive of Entiako Park, in the Southwestern portion of the District. . This includes all woodlots, private land, First Nations reserves, and small parks in the District.

The total project area is 1,335, 456 hectares and covers 123 individual BCGS 1:20,000 mapsheets, approximately 91.1 Full Map Equivalent (FME). The FME is based on 14,666 ha and is used for planning purposes by the photo interpretation contractors. A list of area by map sheet is included in Appendix A.

Summary Information:

Table 2 shows the breakdown of the District according to general land classification attributes in the database. Approximately 70% of the project area is considered vegetated treed. Of the vegetated - treed area, 71% of this has (had) lodgepole pine as the leading species (Table 3). Spruce is the next most abundant leading species covering 13% of the District. The age class distribution shows that 90% of the vegetated-treed area is less than 180 years old (Table 4).

Table 2. General VRI land classification for the Vanderhoof Forest District.

Vanderhoof District		1,387,973.0
Area not to be Inventoried - Entiako Park	52,516.4	
Total Project Area		1,335,456.6
Non - Vegetated (Water, Urban, Rock, etc)	67,770.5	
No data (mostly private land)	38,074.0	
Vegetated Land Base		1,229,612.1
Vegetated non - treed (shrub, herb, agriculture)	304,462.6	
Vegetated Treed		925,149.5

Table 3. Area by leading species for vegetated treed polygons.

Leading Species	Area (ha)	% of Area
Pl	661,323.6	71.5%
Sx	125,197.5	13.5%
At	81,465.7	8.8%
Bl	28,645.9	3.1%
Sb	19,146.8	2.1%
Fd	5,746.2	0.6%
Other	3,624.2	0.4%
Total	925,149.9	100.0%

Table 4. Area by age range and age class for vegetated treed polygons.

Age Range (Class)	Area	% of Area
0 -20 (1)	22,595.0	2.4%
21-40 (2)	52,280.7	5.7%
41-60 (3)	22,089.7	2.4%
61-80 (4)	100,600.7	10.9%
81-100 (5)	162,117.6	17.5%
101-120 (6)	88,072.0	9.5%
121-140 (7)	133,474.9	14.4%
141-180 (8)	250,945.0	27.1%
181-250 (8)	88,083.3	9.5%
250 + (9)	4,890.7	0.5%
Total	925,149.5	100.0%

Existing Data Sources:

Data sources are used as calibration points for improving the quality of photo interpretation. Existing data sources include ground calls, air calls, permanent and temporary samples and observations distributed across the TSA during previous inventories

The Ministry has had a digital calibration tile prepared that shows the locations of all of the historic calibration points. The air call and ground call books, or hard copy photos, from previous inventories are still needed for the actual attribute data .

It is estimated that 5700 inventory data sources are available since the first forest inventory project in 1962 (Table 5). An unknown number of calls were also established in the VRI retrofit that was conducted in the early 2000's. This information still needs to be tracked down.

All data sources will be reviewed by the Contractor to see if they are still relevant before they are used. An unknown number of the established data sources have been 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. 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 and age of the call. For example, data sources in young stands from the 1960's may not be very relevant for species and height data. The data sources in the Pl stands will have to be examined closely to see how relevant they are.

Any data can be used as a calibration data source as long as it has X and Y coordinates. Permanent Sample Plots, cruise plots, timber recce information, and SIBEC plots are examples of other data that can be used. However, it will need to be assembled into a format that the contractor can easily use.

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 5. Calibration points from previous inventory projects.

Year	Air call	Ground Call
1962	2060	337
1963-1974	72	60
1975-1976	357	794
1991-1996	1095	917
2001-2002	?	?
Total	3606	2108

Issues identified at Stakeholder Meeting

Several issues were identified at the stakeholder meeting that should be taken into account when implementing the project

- Secondary structure: understory presence and residual volumes are very important. Identifying presence of understory is just as, or more, important than the accuracy of the attribution of the second layer.
- Data Sources: FREP and SDM data should be provided to the contractor
- TRIM: contractor should update TRIM roads as part of the project
- RESULTS: Interpreters should look closely at linework in recently declared free growing stands as the delineation from the FG surveys is usually good
- Old Growth: 100% dead Pl polygons can still contribute as old growth. Will be important to maintain attributes in the dead layer
- Delineation: in areas of 100% dead polygons, should consider retaining the old linework.
- Species codes: keep species codes consistent; i.e. have only Pl vs Pl and Pli
- Age: Ages in the current inventory are reasonable

Aerial Photography and Photo Scale

Digital frame camera imagery of the entire District was acquired to Ministry photo standards and specifications in the summer of 2012. Flight lines were oriented in an East-West direction and captured at 30cm GSD (ground scale distance), approximately 1:20,000. The digital photography will be processed into the required formats to be used in a 3D Softcopy environment. The digital images will be available as RGBnIr 4 band 8 bit JPEG compressed TIF with a Z\I 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.

It is hoped that the use of the infrared display may make it easier for photo interpreters to identify live vs. dead trees in large areas of MPB mortality. It may also be able to be used to identify presence of understory vegetation.

One hardcopy set of the digital photos will be supplied to the Vanderhoof District office. The hardcopy photos are not the same size or resolution of the traditional air photos.

New Data Sources

The field work program calls for the establishment of air and ground calls to provide the photo interpreters with actual ground data to use a s calibration points. The current standard for distribution of calibration points is a minimum of 10 ground calls and 20 air calls per map FME.

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*. The typical distribution in the Vanderhoof District would be approximately 7:3 ratio of 1-pt versus 3-pt ground call. However, the MPB mortality in the District will definitely affect these numbers. There may be more 3-point calls necessary to adequately record the variability in the residual stands.

The ratio of air to ground calls may also need to be adjusted due to the MPB mortality. It may prove that air calls are more useful to capturing the variability and presence of understory than ground calls. The air calls can cover an entire polygon, while ground calls only cover a small proportion of the polygon.

The exact breakdown of air vs. ground, and 3point vs. one point, will be determined before the project starts and will be based on recommendations from other VRI projects and by reviewing the new images.

Ground calls will not be established on private land.

The Field Calibration Plan provided by the Contractor will outline all the planned work for the field season. The plan must be approved by the Project manager prior to field work commencing.

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.

The intent is to follow the process for delineating and attributing MPB impacted stands now underway in the Kamloops TSA Phase 1 VRI (Appendix B). 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. Contractors are required to incorporate RESULTS information for all non- free growing openings as it exists in the database. For free growing openings, the photo interpreters re-delineate and attribute the polygons if they do not agree with the RESULTS information. Stakeholders have expressed that interpreters should try to maintain existing linework and attributes for openings that have recently been declared free growing.

The RESULTS database indicates approximately 21,000 Opening ID records covering 6200 unique Opening IDs. A PGDB file for the RESULTS openings and tree attributes will be provided to the bidders attending a mandatory project viewing session.

Some openings found on 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. All photo interpretation takes place on the computer screen using 3D software and viewing glasses.

The MPB infestation has caused significant change to the forested landscape in the Vanderhoof District. The focus for the attribute estimation will be on getting accurate descriptions of the live component of the forest. This includes the residual component remaining in the overstory and, where possible, on the understory. It is unknown at this time how successful the project will be at describing the understory.

All polygon descriptions will be carried out to the standards of the most current version of the *VRI Photo Interpretation Procedures*. Attributes will also be captured on the "dead" layer for any stand that has a significant amount of mortality. This information will be stored in layer D. This layer D data is being collected in the Kamloops TSA VRI Phase 1 project. Any refinements to the process that comes from the Kamloops project will be incorporated for the Vanderhoof District.

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 as per the delivery schedule.

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 (FAIB).

TRIM Base

A TRIM (NAD 83) format base files will be supplied to the contractor.

The Contractor will be responsible for updating TRIM roads as part of the project. 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 an approved format. The changes will be passed on to GeoBC to include in future TRIM updates.

Section 3 - Project Implementation

A similar VRI inventory project will be taking place in the Lakes TSA in the same time period. All work in the Vanderhoof project will tie with the Lakes project. The Ministry will arrange for the exchange of delineation and attribution files with the contractors for the Lakes project. For operational efficiency, some Vanderhoof maps on the boundary between the two projects may be done as part of the Lakes project.

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 50% 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 the project.

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.

Project Manager

The Ministry Project Manager for the Vanderhoof District Phase 1 VRI project is Chris Mulvihill, 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. There will be a limit of 4-5 photo interpreters working on the project. This will help to maintain consistency.

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*.

QA for digital map production will be conducted by the Ministry. 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.

The final delivery date for the project will be March 13, 2015. The contract will be set up so that delivery of products will be spread over the term of the project. The delivery dates will be as per the delivery schedule supplied by the Contractor at the start of the project.

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 Vanderhoof District staff and stakeholders.

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 Quality Assurance 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)*
- *VRIMS Personal Geodatabase Structure and Use*
- *VRIMS Vegetation Cover Polygon Validation Rules*

Project Sign-Off Sheet

Vanderhoof Forest District Vegetation Resources Inventory Photo Interpretation Project Implementation Plan

I have reviewed and approved the Vanderhoof Forest District Vegetation Resources Inventory Photo Interpretation Project Implementation Plan.

_____

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

Appendix A: Project Map Sheet Area Summary

Map	Area (ha)	FME
093C092	10,189.7	0.69
093C093	1,604.1	0.11
093F002	4,058.9	0.28
093F003	13,716.4	0.94
093F004	14,487.9	1.0
093F005	14,483.3	1.0
093F006	12,816.7	0.87
093F007	2,041.2	0.14
093F013	4,815.0	0.33
093F014	14,602.3	1.0
093F015	14,780.6	1.0
093F016	15,036.4	1.0
093F017	14,650.4	1.0
093F018	12,612.1	0.86
093F019	6,383.4	0.44
093F020	1,096.0	0.07
093F024	6,748.3	0.46
093F025	14,819.5	1.0
093F026	14,833.6	1.0
093F027	14,990.4	1.0
093F028	14,673.7	1.0
093F029	13,293.2	0.91
093F030	4,476.8	0.31
093F034	1.1	0.00
093F035	12,031.3	0.82
093F036	14,785.7	1.0
093F037	14,978.1	1.0
093F038	14,674.5	1.0
093F039	6,574.7	0.45
093F044	267.2	0.02
093F045	11,172.5	0.76
093F046	14,779.4	1.0
093F047	14,795.1	1.0
093F048	14,836.2	1.0
093F049	12,614.0	0.86
093F050	6,612.2	0.45
093F053	215.1	0.01
093F054	11,006.7	0.75
093F055	14,077.8	0.96
093F056	14,781.0	1.0
093F057	14,768.7	1.0

Map	Area (ha)	FME
093F058	14,824.0	1.0
093F059	14,728.4	1.0
093F060	14,621.1	1.0
093F063	8.5	0.00
093F064	1,425.5	0.10
093F065	6,294.9	0.43
093F066	14,938.1	1.0
093F067	14,748.5	1.0
093F068	14,719.1	1.0
093F069	14,666.4	1.0
093F070	14,702.1	1.0
093F075	8,213.7	0.56
093F076	14,387.2	1.0
093F077	14,677.2	1.0
093F078	14,684.4	1.0
093F079	14,671.3	1.0
093F080	14,621.9	1.0
093F084	2,704.0	0.18
093F085	7,101.1	0.48
093F086	14,562.2	1.0
093F087	14,657.9	1.0
093F088	14,657.0	1.0
093F089	14,668.9	1.0
093F090	14,699.5	1.0
093F094	10,652.9	0.73
093F095	14,753.7	1.0
093F096	14,678.3	1.0
093F097	14,591.7	1.0
093F098	14,612.6	1.0
093F099	14,614.5	1.0
093F100	14,615.2	1.0
093G042	94.4	0.01
093G051	9,946.3	0.68
093G052	12,602.6	0.86
093G053	12,009.9	0.82
093G054	1,490.4	0.10
093G061	14,700.5	1.0
093G062	14,770.4	1.0
093G063	7,195.8	0.49
093G071	14,694.4	1.0
093G072	14,679.4	1.0

Map	Area (ha)	FME
093G073	4,225.4	0.29
093G081	14,664.5	1.0
093G082	14,590.2	1.0
093G083	11,944.4	0.81
093G091	14,615.2	1.0
093G092	14,590.2	1.0
093G093	12,004.9	0.82
093J001	14,580.4	1.0
093J002	14,408.2	1.0
093J003	3,491.2	0.24
093J011	14,549.3	1.0
093J012	11,321.8	0.77
093J013	2,515.9	0.17
093J021	1,086.9	0.07
093K004	3,767.6	0.26
093K005	11,236.3	0.77
093K006	14,610.1	1.0
093K007	14,518.1	1.0
093K008	14,587.7	1.0
093K009	14,581.1	1.0
093K010	14,591.7	1.0
093K015	8,095.2	0.55
093K016	14,675.3	1.0
093K017	14,451.4	1.0
093K018	14,504.2	1.0
093K019	14,589.5	1.0
093K020	14,552.5	1.0
093K025	1,685.4	0.11
093K026	13,992.8	0.95
093K027	14,426.9	1.0
093K028	12,861.3	0.88
093K029	14,499.2	1.0
093K030	8,967.7	0.61
093K035	1,355.9	0.09
093K036	12,928.9	0.88
093K037	3,210.8	0.22
093K038	725.1	0.05
093K039	5,727.2	0.39
093K040	12.2	0.00
093K046	2,700.1	0.18
093K047	146.3	0.01
Total	1,335,456.9	91.1

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 (MPB) 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 MPB. 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.

Field Calibration:

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 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.

Appendix C: VPIP Meeting

Attendees at the VPIP meeting held at the Vanderhoof District office on June 5, 2012:

Name	Affiliation
Roman Bilek	Forest Analysis and Inventory Branch - Victoria
Chris Mulvihill	Forest Analysis and Inventory Branch - Nelson
Delee Anderson	Vanderhoof Forest District
John Degagne	Vanderhoof Forest District
Tony Wipfli	Vanderhoof Forest District
Dion Oake	FLSM
Britt Yorston	Vanderhoof Forest District
Kathleen Hebb	Vanderhoof Forest District
Cathy Middleton	Vanderhoof Forest District
Gord Saito	Vanderhoof Forest District
Alan Gilchrist	Vanderhoof Forest District
Blaine Anderson	Stuart-Nechako Business Area BC Timber Sales
Ian Stephen	Canfor
Nathan Voth	Vanderhoof Forest District