
Vegetation Resources Inventory

Williams Lake TSA

VRI Project Implementation Plan for Photo Interpretation

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Forest Analysis and Inventory Branch

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1 Introduction and Background Information

1.1 Introduction

The Ministry of Forests ("Ministry") has developed a planning process to ensure the successful implementation of Vegetation Resources Inventory ("VRI") photo interpretation projects. The VRI Project Implementation Plan ("VPIP") is a working document detailing the operational activities associated with implementing and documenting a forest inventory project. It identifies the target areas for new photo interpretation, data sources, the format of base files, project scheduling, deliverable expectations, and other considerations. Ministry-certified photo interpreters produce VRI photo-interpreted inventories. The Ministry ensures that completed projects meet the current standards, are congruent with the Forest Analysis and Inventory Branch ("FAIB") business plans, and meet the needs of all the consulted parties.

1.2 Background

The Ministry has identified a need to complete a new VRI in the Williams Lake Timber Supply Area ("TSA"). A new VRI provides a strategic planning inventory at the management unit level designed to answer two fundamental questions: where the resource is and how much there is.

The VRI is a formalized summary of knowledge about the overall condition of the forest land base. A continuous series of British Columbia Geographic System ("BCGS") 1:20,000 scale map sheets indicate forest cover using several descriptors. VRI information supports a broad spectrum of forest management activities:

- assessing forest biodiversity and old growth
- wildlife habitat and watershed modelling
- timber supply reviews
- other applications to ensure sustainable management of forest resources are

The Williams Lake TSA is in the northwestern portion of British Columbia's Cariboo Natural Resource Region. The Cariboo-Chilcotin Natural Resource District Office administers the TSA. The Williams Lake TSA borders the Quesnel TSA and Robson Valley TSA to the north, the Kamloops TSA and 100 Mile House TSA to the east, the Lillooet TSA and Sunshine Coast TSA to the south, and the Great Bear Rainforest ("GBR") North TSA and GBR South TSA to the west.

The Williams Lake TSA is approximately 4.93 M ha, including parks and all ownerships. Figure 1 below illustrates the Williams Lake TSA.

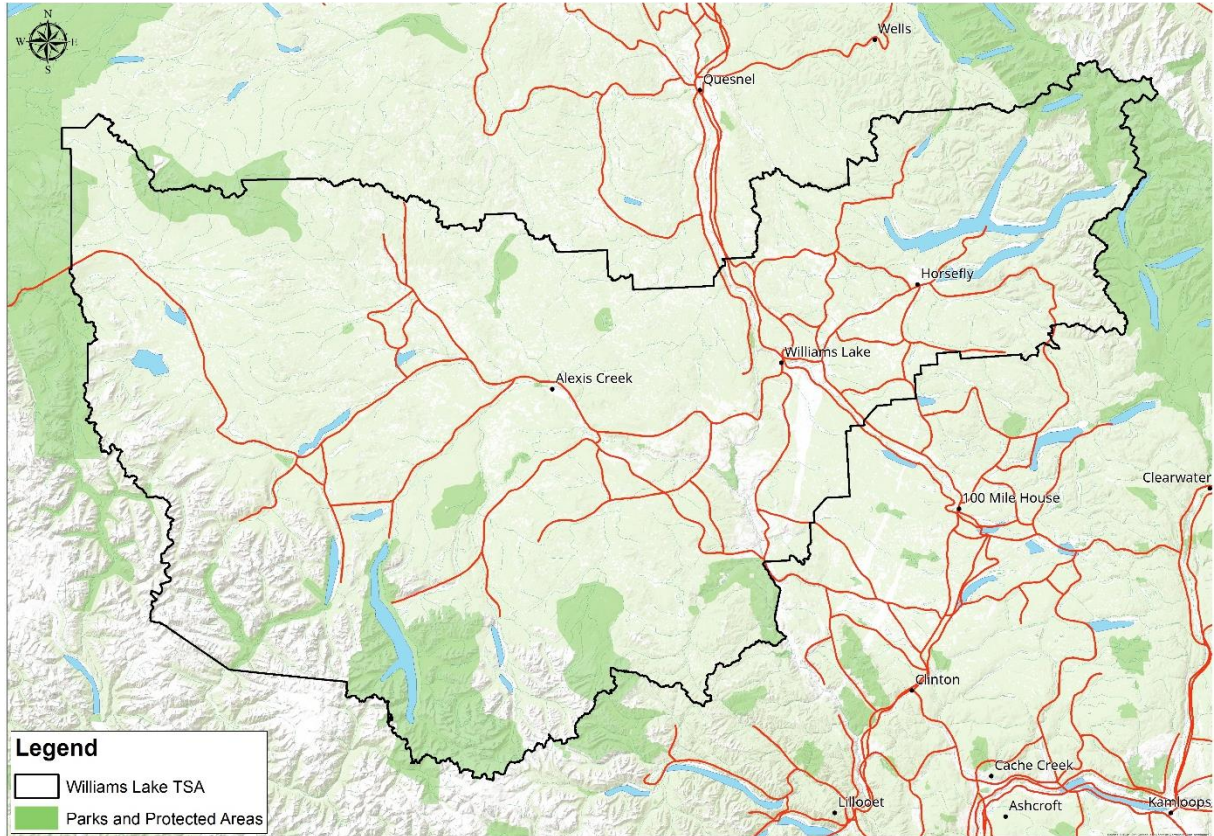


Figure 1. Williams Lake Timber Supply Area

2 Photo Interpretation Plan

2.1 Project Objectives

FAIB has developed a ten-year provincial inventory action plan to update older inventories to the current VRI standard, provide full inventory coverage across BC to eliminate any data gaps and update the currency of the inventory.

The overriding objective of this re-inventory project is to produce a new photo-interpreted inventory to account for the accumulated change in the Williams Lake TSA since the last re-inventory. The changes are attributable to annual harvesting and planting, insect and disease mortality, salvage harvesting, wildfires, and realized differences between modelled growth since the last re-inventory and actual growth on the land base.

The new inventory will provide much-needed information on the spatial distribution of live and dead stands, update species compositions to reflect insect and disease mortality and harvesting, and estimate dead standing volume in the project area.

2.2 The Current Inventory in the Williams Lake TSA

The eastern half of the Williams Lake TSA was inventoried to full VRI standards between 2009 and 2014. In addition, the Ministry completed fire updates in 2017 and 2018 in the central and northern portions of the TSA.

The western half of the TSA was inventoried to the earlier Forest Cover standard in the 1950s and 1960s. This data is some of the oldest inventory in the province. A significant portion was subsequently re-inventoried in 2013 with a Landscape Vegetation Inventory ("LVI") to account for mountain pine beetle ("MPB") loss. The LVI was an interim measure and not intended as a long-term inventory.

The Ministry has updated the inventory in the Williams Lake TSA annually to reflect changes from disturbance (e.g., fire and harvesting) through electronic data submissions from licensees and the government. The Ministry also used satellite imagery to detect and update the inventory for any additional changes in forest cover not recorded in the data submissions.

The 2015 Williams Lake TSA Timber Supply Review ("TSR") indicated uncertainty about the losses in Douglas-fir leading stands due to Douglas-fir beetle inside fire boundaries. There was also uncertainty about the status of fire-killed and MPB-impacted Lodgepole pine stands in terms of remaining live and dead standing volume and the degree of natural regeneration.

The Cariboo-Chilcotin Natural Resource District and BC Parks have identified the following:

- Avalanche chutes are not delineated separately from the surrounding forest. In many cases, these are essential features for mapping Grizzly bear habitats.
- Whitebark pine is thought to exist in the project area, and its distribution is not well defined in the current inventory.

2.3 Chilcotin VRI Project Area

The Chilcotin VRI project boundary (Figure 2) will not match the Williams Lake TSA boundary because the TSA's eastern half and northern edge have recent VRI data. The Williams Lake TSA is 4.93 M ha, while the Chilcotin VRI project area is approximately 3.19 M ha, including 0.40 M ha in Tweedsmuir Provincial Park. The Chilcotin VRI project equals 208 full map sheet equivalents ("FME") based on an average British Columbia Geographic System ("BCGS") map sheet size of 15,334 ha/FME at this latitude.

The final boundary of the Chilcotin VRI project area at the time of contract signing may differ slightly from the planning area boundary to ensure that the finalized boundary fits seamlessly with newer forest inventories in adjacent TSAs.

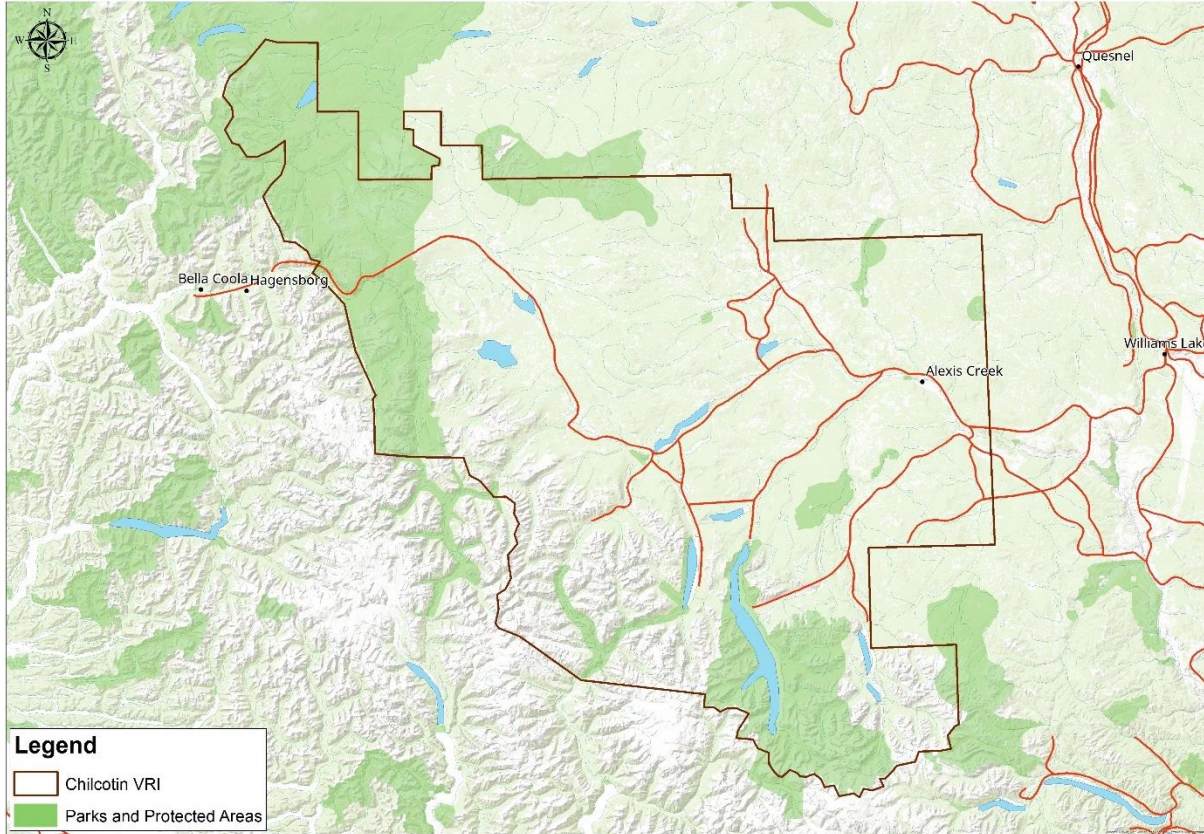


Figure 2. Chilcotin VRI Project Boundary

The Chilcotin Plateau dominates the Chilcotin VRI project area, while a series of mountain ranges bound the more southern and western portions. Several large lakes occupy the project area, with Chilko Lake being the largest. The community of Alexis Creek sits in the project area near the eastern boundary, and the community of Hagensborg sits immediately west of the project area. In addition, the project area includes provincial parks and protected areas, First Nations reserves, private land and other ownerships or uses. The Chilcotin VRI project area is, however, predominately Crown forest. Highway 20 traverses the project area, and several paved and gravel-surfaced roads stem from it.

Table 1 provides an area summary of the project area by ownership.

Table 1. Area summary of land use in the Williams Lake West VRI project area

Primary Land Use	Area (ha)
Crown Forest Management Unit	2,159,666
Conservancy Areas, Ecological Reserves, Protected Areas, Parks	783,268
Community Forest Agreement	114,320
Private Land	43,462
Crown Miscellaneous Reserve	22,617
Community Watershed	21,417
Indian Reserve	15,284
Forest Recreation Reserve	10,634
Crown Miscellaneous Reserve	5,271
Woodlot License Agreement	3,984
Use, Recreation and Enjoyment of the Public (UREP) Reserve	2,732
Unknown Ownership/Exception	1,108
Dominion Government Block & Federal Parcel	1,023
Tree Farm Licence	730
Wildlife Management Area	527
Municipal Parcel	101
Crown Miscellaneous Lease	77
Total	3,186,221

There are ten biogeoclimatic ecosystem classification ("BEC") zones in the Chilcotin VRI project area (Table 2), though five of these collectively occupy > 90% of the project area.

Table 2. Biogeoclimatic zones in the Chilcotin VRI project area

Biogeoclimatic Zone	Area (ha)	Area (%)
SBPS – Sub-Boreal Pine Spruce	1,068,831	34
ESSF – Engelmann Spruce Subalpine Fir	595,162	19
IDF – Interior Cedar Hemlock	484,025	15
MS – Montane Spruce	445,217	14
BAFA – Boreal Altai Fescue Alpine	382,932	12

Biogeoclimatic Zone	Area (ha)	Area (%)
CMA – Coastal Mountain-heather Alpine	71,676	2
SBS – Sub-Boreal Spruce	51,822	2
CWH – Coastal Western Hemlock	46,762	1
MH – Mountain Hemlock	34,197	1
IMA – Interior Mountain-heather Alpine	5,596	< 1
Total	3,186,220	100

Pine-leading stands, followed by stands leading in spruce, Douglas-fir and balsam fir, dominate the current forest inventory in the Chilcotin VRI project area (Table 3). Deciduous, hemlock, and cedar-leading stands comprise < 4% of the current inventory. About one-third of the Chilcotin VRI project area is non-treed.

Table 3. Leading species distribution in the Chilcotin VRI project area

Leading Species	Area (ha)	Area (%)
Pine	1,441,709	70
Spruce	202,642	10
Douglas-fir	173,036	8
Balsam	170,189	8
Aspen	65,972	3
Hemlock, Cedar and Other Coniferous	9,188	< 1
Other Deciduous	3,685	< 1
Total	2,066,421	100

The polygon delineation and attribute estimation project stages (see Section 3) will occur on the entire Chilcotin VRI project area.

Approximately 875,000 ha (27%) of the Chilcotin VRI project area is incompatible with the field calibration project stage (see Section 3), and all field calibration plans and work will exclude these areas. Other portions of the project may have procedural (e.g. no helicopter use) or temporal (e.g. not before a specific date) constraints that define how and when the VRI Contractor will complete field calibration work.

BC Parks may authorize field calibration work in some provincial parks and protected areas. No field calibration work will occur in Ts'yl-os Park at the request of First Nations.

The portions of Community Forest Agreement K2Z outside Patterson Lake Park, and not otherwise excluded, are excluded from the field calibration land base.

The Cariboo Natural Resource Region has requirements for several wildlife species, specifically, no field calibration work in :

- Woodland caribou Ungulate Winter Range ("UWR") from May 15 to July 1;
- Mountain goat and Bighorn sheep habitat from November 1 to April 30 and May 1 to July 15; and
- American white pelican habitat around specific lakes at all times of the year

The portions of the Tsilhqot'in Nation Declared Title Area not otherwise excluded are within the field calibration land base.

Table 4 summarizes the exclusions from the field calibration land base.

Table 4. Exclusions from the field calibration land base

Primary Land Use	Area (ha)
Conservancy Area, Ecological Reserve, Protected Area, Park*	784,856
Private Land	43,462
Indian Reserve	15,284
Forest Recreation Reserve	10,634
American White Pelican Habitat	9,739
Crown Miscellaneous Reserve	5,271
Use, Recreation and Enjoyment of the Public (UREP) Reserve	2,732
Unknown Ownership	1,108
Dominion Govt. Block & Federal Parcel	1,023
Wildlife Management Area	527
Municipal Parcel	101
Crown Miscellaneous Lease	77
Total Exclusions	874,814

*includes Patterson Lake Park within Community Forest Agreement K2Z

2.4 Inventory Information Sources

New and other data sources provide critical reference information, such as base mapping or other data. Photo interpreters will integrate this data into the new VRI. New and other existing data sources may include the following:

- Reporting Silviculture Updates and Land Status Tracking System ("RESULTS") data

- Base map information such as Fresh Water Atlas ("FWA") water features and Digital Roads Atlas ("DRA") road features
- Biogeoclimatic ("BEC") Zone mapping
- Forest Health mapping
- Historical field measurement data collected during previous inventory projects and corresponding aerial photography (if available)
- The existing forest inventory for the project area
- Digital orthorectified photography
- Digital frame aerial photography

Standards, Procedures and final deliverable formats for VRI photo interpretation projects are as described on FAIB's Photo Interpretation Procedures page:

<https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/forest-cover-inventories/photo-interpretation/standards>

3 Project Specifications

3.1 Project Photography

The Province acquired digital frame camera imagery of the project area to GeoBC photo standards and specifications in the summer of 2021 and 2022. The products are:

- 4-band 8bit RGBI digital frame imagery at 25cm ground sample distance ("GSD"); Flight orientation is east-west and west-east
- ISSD ZVI stereo project file in UTM NAD 83 projection;
- 50 cm colour orthophotos;
- Photo index shapefile with image names and locations; and
- Various metadata

3.2 Stages of Photo Interpretation

VRI projects have three stages which occur in succession: polygon delineation, field calibration and attribute estimation. Quality Assurance is a concurrent component in each stage.

A project prework meeting is mandatory, and most projects have stage-level prework meetings each fiscal year. These meetings aim to bring together the Ministry Project Manager, VRI Contractor, and Quality Assurance personnel before project start-up. These meetings establish an efficient communication network, 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. In addition, the Ministry and photo interpretation contractor may agree to minor contract changes due to these meetings. The Ministry uses a project prework checklist to organize and guide the sessions, and all attending parties sign off.

3.2.1 Polygon Delineation

The BC Land Cover Classification Scheme ("BCLCCS") is the basis for polygon delineation. This classification scheme includes both vegetated and non-vegetated cover classes. Photo interpreters delineate the project area using BCLCCS into vegetated or non-vegetated polygons based on mensuration attributes (i.e. species, age, height and crown closure) and ecological attributes.

Vegetated polygons with distinct or indistinct boundaries must have a minimum 2 ha or 5 ha polygon size. Alpine-designated polygons will have a minimum area of 5 ha. FAIB will supply RESULTS openings and FWA polygon features for incorporation into the VRI.

3.2.2 Field Calibration

The VRI Contractor's photo interpreters establish field calibration points for the attribute estimation stage. Calibration points include low-level helicopter flights over stands of interest (air calls) and field ground visitations (ground calls). Ground calls require access by truck or helicopter.

Photo interpreters collect forest mensuration attributes such as species, age, height and basal area. The field calibration program allows the interpreters to gain familiarity with the project area, and the data acts as reference points during the subsequent attribute estimation stage.

The field calibration program will establish a minimum of 10 ground calls and 20 air calls per FME. The ground calls will be a combination of 1-point and 3-point ground calls. The species complexity described in the *VRI Field Calibration Procedures for Photo Interpretation* determines the type of ground call established in each polygon.

It is unlikely that the project will have 1-point ground calls established, given the need to explore the variation within lodgepole pine leading stands and the prevalence of that forest type within the project area.

The Ministry and VRI Contractor will coordinate with the Cariboo-Chilcotin Natural Resource District Office to access areas beyond road gates.

A VRI Contractor is not permitted to establish field calibration plots in areas where access is unapproved.

Before the field calibration work begins, the VRI Contractor submits a Field Calibration Plan ("FCP") to the Ministry for review and approval to ensure the FCP accommodates all identified issues and observes the access constraints. As part of the final project deliverables, the Ministry requires the VRI Contractor to deliver a complete set of new field calibration data sources in a digital format determined by the Ministry, including their geographical locations (e.g. UTM coordinates).

3.2.3 Attribution Estimation

Photo interpreters describe the previously delineated polygons with estimates of polygon characteristics or transfer information relating to the polygon from other data sources.

The attribute suite consists of general attributes that include information about the polygon and descriptions of ecological characteristics.

Attributes are polygon-based estimates. Each polygon has a unique identifier, and photo interpreters make subsequent qualitative and quantitative measurements for all vegetated and non-vegetated covers in the polygon observed in the imagery. Photo interpreters can describe cover types within the polygon that are too small to delineate as additional land cover components.

3.2.4 Quality Assurance

An independent 3rd-party contractor (independent of the Contractor performing the VRI photo interpretation and field calibration work) conducts Quality Assurance ("QA") during all project stages. The QA auditor is present at the initial prework meeting held by the Ministry with the VRI Contractor. The VRI Contractor's deliverables must meet or exceed the *VRI Photo Interpretation Quality Assurance Standards* at each stage of a VRI project.

4 Project Scheduling

The Ministry will likely split the Williams Lake West VRI project area into two or three separate contracts to complete the work, starting up to a year apart.

Table 2. The proposed project schedule for the first Williams Lake West VRI project.

Fiscal Year	Prime Activity
2022/2023 & 2023/2024	VIP planning Contract Planning and Development
2024/2025	Contract Award Delineation Field Calibration Attribution
2025/2026	Delineation Field Calibration Attribution
2026/2027	Delineation Field Calibration Attribution Contract Evaluation

The Ministry will set a detailed delivery schedule outlining the progressive delivery of products for each fiscal year in consultation with the VRI Contractor.

4.1 Roles and Responsibilities

4.1.1 Ministry Project Manager

The Ministry's project manager:

- Coordinates the project,
- Monitors project progress,
- Ensures the Contractor's photo interpreters are qualified and certified,
- Oversees the photo-interpretation activities
- Ensures that Quality Assurance is complete and delivered for each stage,
- Authorizes payments, and
- Assists in coordinating technical support where required.

4.1.2 VRI Photo Interpretation Contractor

The VRI Contractor works with the Ministry's Project Manager to ensure the planning, coordination and execution of project activities are consistent with the VPIP and contract. The VRI Contractor will provide a minimum of four (4) photo interpreters on the project to maintain data consistency. In addition, there will be one VRI-certified photo interpreter for every non-certified photo interpreter if the latter participates.

4.1.3 VRI Quality Assurance Contractor

A third-party Quality Assurance auditor independent of the VRI contractor or the Ministry performs Quality Assurance activities. In either event, the Quality Assurance Contractor or Ministry Quality Assurance personnel is a VRI-certified photo interpreter with a minimum of 10 years of VRI experience. When the Ministry includes a third-party Quality Assurance contractor, the Ministry ensures that Quality Assurance reporting meets the prescribed VRI standards.