Vegetation Resources Inventory

Kitlope Vegetation Resources Inventory - Project Implementation Plan

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Section 1 Introduction

Background and Overview of the Inventory Process

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 describing the key reasons and objectives for carrying out a new inventory project. The VPIP identifies the project areas to be inventoried through the VRI photo interpretation process, issues with the current inventory for those areas, and key steps required to be carried out for successful completion of projects. VRI photo interpreted inventories are produced by Ministry-certified photo interpreters, which are reviewed and approved by the Ministry to ensure that projects are completed to current standards, are congruent with the Forest Analysis and Inventory Branch ("FAIB") business plans, and to ensure the project meets the needs of all the consulted parties.

The Ministry has identified a need to complete a new VRI within the Coast Mountains Natural Resource District ("CMNRD"). A new VRI provides a strategic level planning inventory at the management unit level and is designed to answer two basic questions:

- where is the vegetation resource (e.g., trees, shrub types, wetlands, etc.) located? and,
- how much of a given vegetation resource is within a given inventory unit?

The VRI is a formalized summary of knowledge about the overall condition of the forest land base and is typically depicted as a continuous series of British Columbia Geographic System ("BCGS") 1:20,000 scale map sheets that indicate forest inventory information using a number of descriptors. The VRI information is used for a wide spectrum of forest management purposes including assessment of forest biodiversity and old growth, wildlife habitat modelling, watershed modelling, timber supply reviews and many other applications to ensure that forest resources are managed and conserved sustainably.

Project Planning Area

The CMNRD is in the northwestern part of British Columbia in the Skeena Natural Resource Region. The CMNRD office in Terrace administers an area of roughly 80,000 square kilometers that includes the communities of Terrace, Kitimat, Prince Rupert, the Nass Valley, and Stewart. There are five Timber Supply Areas ("TSA") and three Tree Farm Licences ("TFL") within the CMNRD, as well as the Terrace Community Forest, First Nation Woodland Licenses and three woodlot license tenures. Furthermore, part of the Nisga'a treaty lands under the Nisga'a Final Agreement falls within the CMNRD.

Due to the vast size of the CMNRD and the number of management units, the new VRI is currently focussed on re-inventorying approximately 2.3 million hectares of the CMNRD. This large project unit will be referred to as the Coast Mountains VRI ("CMVRI") planning area. The CMVRI planning area will be completed in two to three smaller VRI project area units for project management purposes, with planning and implementation being conducted over the next two to three years.

Figure 1 illustrates the CMVRI planning area location within the Coast Mountains Natural Resource District.

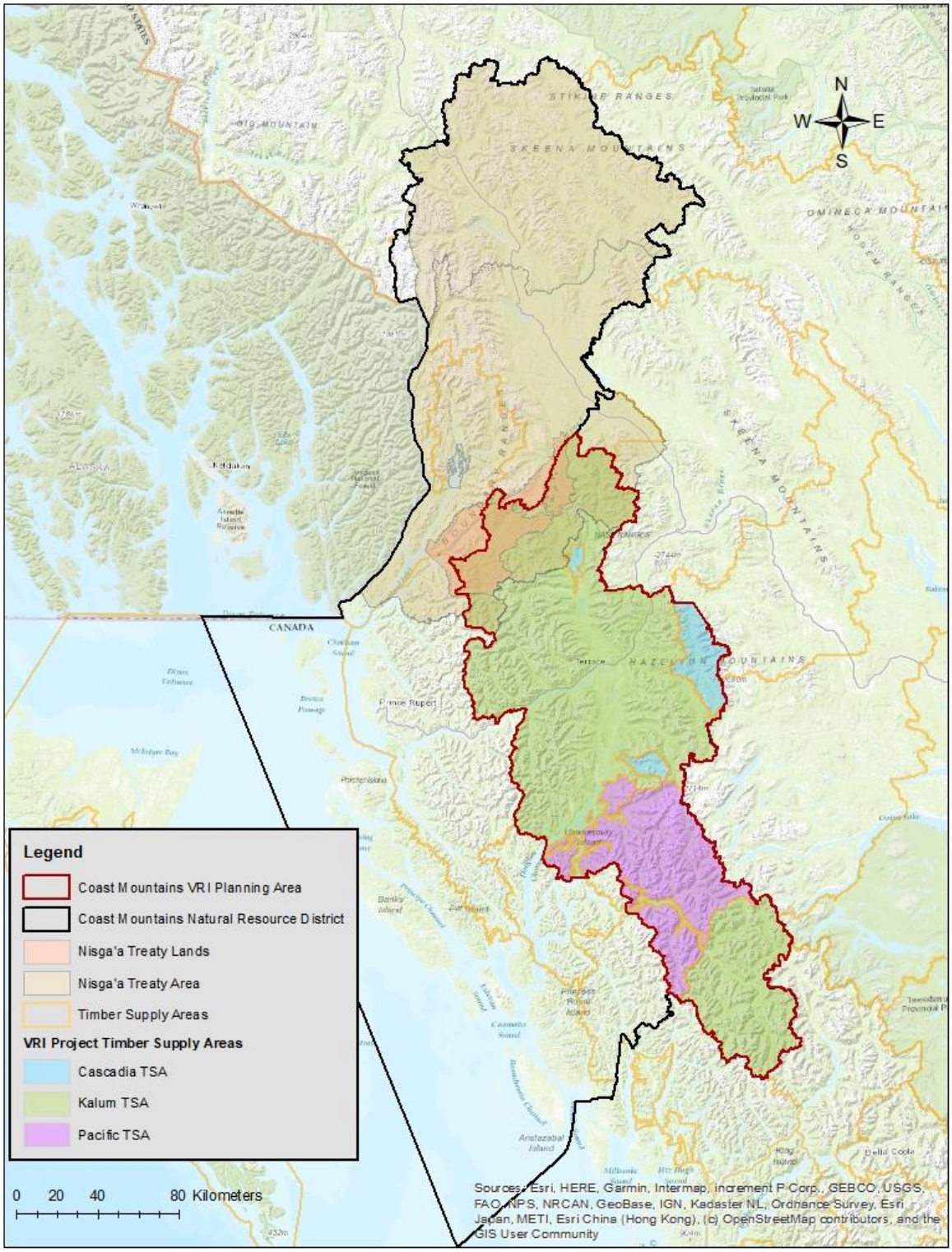

Figure 1 CMVRI Planning Area within the CMNRD

Table 1 summarizes the TSAs for the CMVRI planning area. Note that the Cascadia and Pacific TSAs are comprised of Timber Supply Blocks ("TSB") located within the CMVRI planning area and in other areas of the province. Only the TSBs relevant to the CMVRI planning area are included in the table.

Timber Supply Area	Timber Supply Block	Area (ha)	% Total CMVRI Planning Area
Cascadia TSA	Block 9	19,754	< 1
	Block 10	83,237	3.6
	Block 11	10,854	< 1
Cascadia TSA Total		113,845	5.0
Kalum TSA Total		1,759,495	76.5
Pacific TSA	Block 28A	310,095	13.5
	Block 28B	72,976	3.2
	Block 28C	15,358	< 1
	Block 28D	4,157	< 1
	Block 28E	1,135	< 1
	Block 28F	889	< 1
	Block 28G	530	< 1
	Block 28H	93	< 1
	Block 29	21,454	< 1
Pacific TSA Total		426,687	18.5
Grand Total		**2,300,592**	**100%**

Table 1 Summary of TSAs within the CMVRI Planning Area

Table 2 summarizes the area of TFLs, community forest, First Nation Woodland License, and woodlots within the CMVRI planning area.

Management Unit	Schedule A Area (ha)	Schedule B Area (ha)	Total Area (ha)	% Total CMVRI Planning Area
TFL 1	612	422,744	423,357	18.4
TFL 41	n/a	201,792	201,792	8.8
Community Forest (K1X)	n/a	25,166	25,166	1.1
First Nation Woodland License (N1D)	n/a	20,885	20,885	< 1
Woodlots	58	1,816	1,874	< 1
Total	**670**	**672,403**	**673,073**	**29.2%**

Table 2: Summary of TSAs within the CMVRI Planning Area

Section 2 Project Objectives and Current Inventory Status

Project Objectives

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

The overriding objective for the CMVRI planning area is to produce an updated photo interpreted inventory described to the current standards which will account for the accumulated change in the CMNRD since its 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. Furthermore, the inventory process will create new forest inventory data for the Huchsduwachsdu Nuyem Jees / Kitlope Heritage Conservancy ("the Conservancy"). Approximately 311,000 hectares of the total Conservancy area has no historical forest inventory information.

The new inventory will provide much needed current information on the spatial distribution of live and dead stands, update species compositions to reflect insect, disease and weather-related mortality and harvesting, as well as provide an estimate of dead standing volume in the CMVRI Planning Area.

State of the CMVRI Planning Area Current Inventory

The current forest inventory for the CMVRI planning area consists of several components and vintages:

- Forest Inventory Planning ('FIP') data generated from air photo interpretation ranging from the 1960s to mid-1990s, that has been converted to the VRI format;
- Original VRI data from 1997 for the Kitimat Valley;
- newer VRI data along the eastern boundary of the planning area where VRI projects in adjacent TSAs such as the Morice overlapped; and
- "I" standard records that are generated via annual updates for depletions, regeneration, and free-growing declarations sourced from the corporate RESULTS (REporting Silviculture Updates and Land status Tracking System) database.

There are also significant voids in the provincial forest inventory data where inventory data has not been created or made available to the Ministry, including the Conservancy and TFL 41.

Figure 2 illustrates the currency of the forest inventory for the CMVRI planning area.

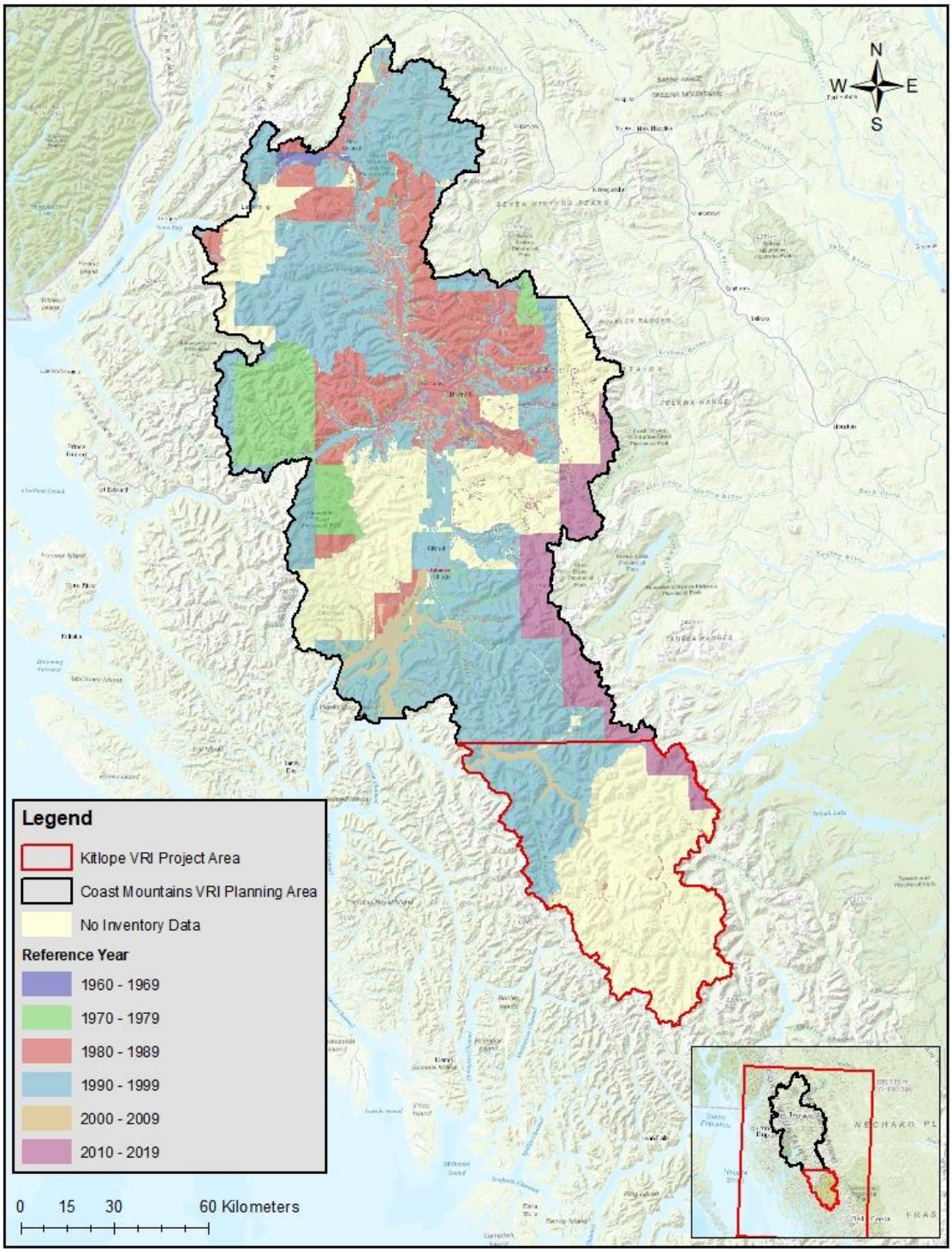

Figure 2 Currency of the forest inventory within the CMVRI Planning Area

The following concerns with the current forest inventory, and applicable to the Kitlope VRI project area, have been identified during the timber supply review processes for the Kalum, Cascadia and Pacific TSAs, as well as from discussions with BC Parks about the Conservancy:

- Age and reliability of the current forest inventory;
- Lack of forest inventory for the Huchsduwachsdu Nuyem Jees / Kitlope Heritage Conservancy, which limits strategic-level planning and management of many ecological and wildlife values;
- Estimates of dead standing tree volumes;
- Descriptions of western redcedar and yellow cedar stands which are important cultural species to First Nations;
- Accuracy of vegetation cover descriptions for habitat modelling (i.e., avalanche chutes for grizzly bears and tree species for avian nesting); and,
- Changes to species composition because of any wildfire losses and forest health impacts.

Kitlope VRI Project Area

The Kitlope VRI project area is the first area to be selected for re-inventory within the CMVRI planning area. Figure 3 illustrates the area of the Kitlope VRI project. The Kitlope VRI project area covers approximately 468,436 hectares within the larger CMVRI planning area. This project area is equivalent to 31.5 BCGS Full Map sheet Equivalents (“FME”) based on an average of 14,881 ha per FME. The final boundary of the Kitlope VRI project area at time of contract signing may be slightly different than the planning area to ensure that the final inventory boundary fits seamlessly with newer forest inventories in adjacent TSAs.

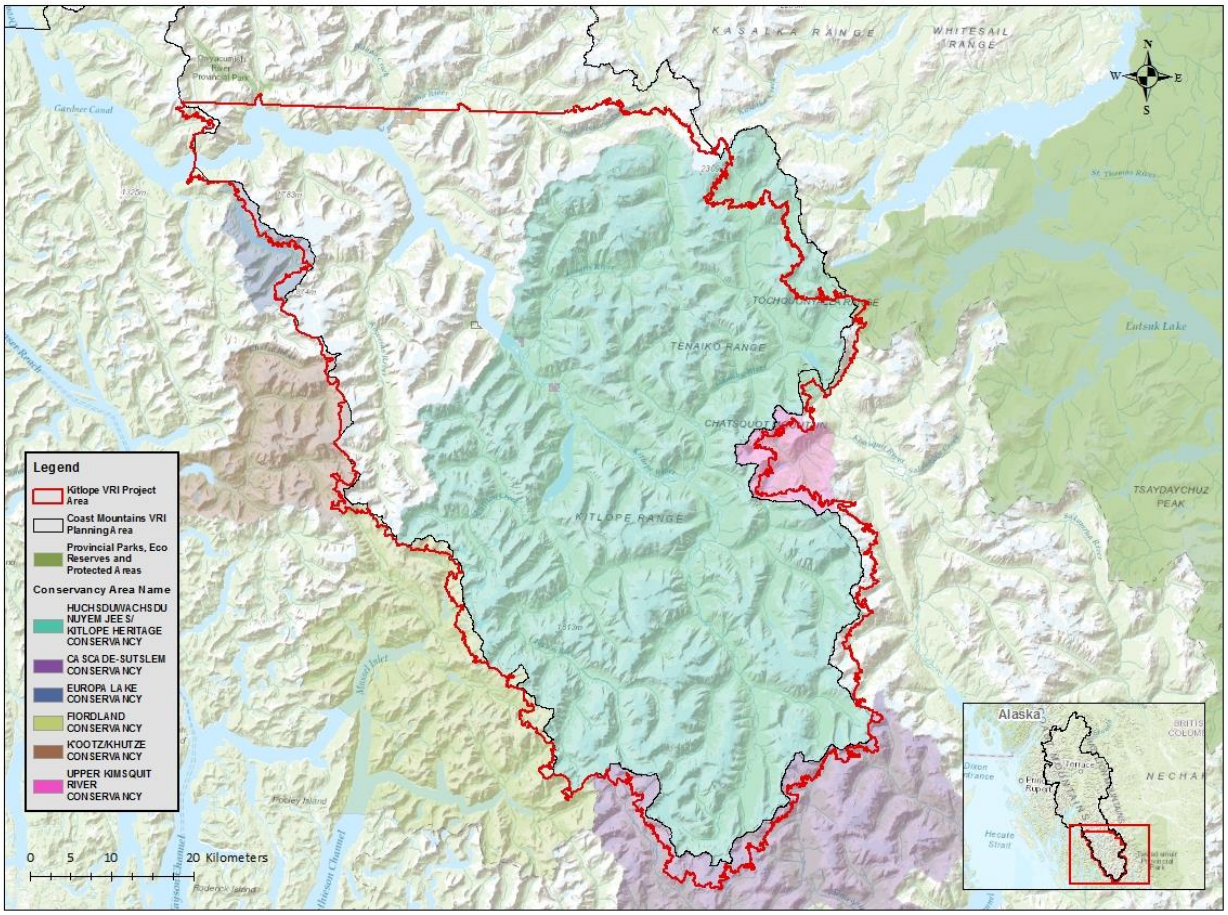

Figure 3 Kitlope VRI Project Area Location Overview

The Kitlope VRI project area is very remote with no immediate communities in the area. The nearest Haisla community is Kitamaat Village, approximately 100 kilometers due southwest of the area by air and 125 kilometers by water. Two other communities, Hartley Bay and Bella Coola, are also within close proximity of the project area by air. The towns of Kitimat and Terrace are the closest municipalities.

The Kitlope VRI project area is primarily comprised of steep-sided valleys and dramatic domed granite peaks, with glacial landforms and icefields found in the headwaters of the Kitlope and Tsaytis watersheds, and the Kitlope River estuary at the head of the Gardner Canal. Due to the steepness of the terrain, low elevation areas are limited to the valley floors which are often only one to two kilometers wide.

The Conservancy was established in 1996 to protect one of the world's largest undeveloped coastal temperate rainforest and to protect Haisla Nation cultural values. Apart from a small amount of logging outside of the Conservancy, the Kitlope VRI project area is essentially undisturbed. The vegetation of the Kitlope VRI project consists primarily

of old-growth coastal rainforest at lower elevations, diminishing in size and changing in composition with increasing elevation to scattered subalpine stands and alpine ecosystems.

There are three biogeoclimatic ecosystem classification ("BEC") zones in the Kitlope VRI project area (Table 3). These zones lie at different elevations, with CWH at the lowest elevation, MH above and CMA at the highest elevations.

Biogeoclimatic Zones	Area (ha)	% of Project Area
Mountain Hemlock (MH)	203,218	43.4
Coastal Western Hemlock (CWH)	152,707	33.0
CMA - Coastal Mountain-heather Alpine (CMA)/ Boreal Altai Fescue Alpine (BAFA)	110,411	23.6
Engelmann Spruce-Subalpine Fir (ESSF)	98	<1
Total	**468,436**	**100.0%**

Table 3 Biogeoclimatic zones in the Kitlope VRI project area

The forest inventory in the Pacific TSA portion of the Kitlope VRI project area (Table 4) is dominated by hemlock-leading stands, followed by stands that are leading with balsam (true fir), red and yellow cedar, Sitka spruce. Deciduous species, pine and Douglas-fir make up about 1% total of the current known inventory within the Kitlope VRI project area. The Conservancy makes up the majority of the Kitlope VRI project area and it has no historical forest inventory information. However, the forests of the Conservancy are assumed to be like that of the area represented by the portion in the Pacific TSA.

Leading Species	Area (ha)	% Current Known Inventory
Hemlock (H, HM, HW)	44,985	81.1
Balsam (B, BA, BL)	4,617	10.6
Cedar (CW, YC)	2,477	4.3
Spruce (S, SS)	1,582	2.8
Deciduous (DR, AC, ACT)	258	< 1%
Pine (PL, PLI)	193	< 1%
Fir (FD, FDI)	93	< 1%

Subtotal	**54,204**	
Non-Treed Vegetated	15,682	
Non-Vegetated	95,150	
Subtotal Non-Teed/ Non-Veg	110,832	23.6
No historical forest inventory information	303,400	64.8
Total Project Area	**468,436**	**100**

Table 4 Leading tree species in the Pacific TSA portion of the Kitlope VRI project area

The Kitlope VRI project area includes some areas with specific objectives or land uses that are incompatible with the field work required for this project. These areas, which include private land, federal lands (including Indian Reserves), provincial parks, protected areas and ecological reserves, and legally specified areas for wildlife purposes will be excluded from any field work plans (Table 5).

Non-specified areas where wildlife may be encountered are included in field work but will have operational and seasonal conditions that define how and when field activities are done.

Primary Land Use	Area (ha)	% Project Area	Field Work (included/excluded)
Private Land	540	< 1	Excluded
Parks, Protected Areas, and Ecological Reserves	347	<1	Excluded
Federal Indian Reserves and Parcels	142	< 1	Excluded
Wildlife Habitat Areas (Grizzly Bear)	3,952	<1	Excluded
Ungulate Winter Range (Mountain Goat)	7,672	1.6	Excluded
Total Area Excluded	**4,981**	**1%**	
Conservancy Area*	332,140	71.3	Included
All other Crown Forest Land	117,626	26.1	Included

Total Area Included	**468,436**		

Table 5 Land use categories by total area within the Kitlope VRI Project Area

*Note that Conservancy Area includes the majority of the Kitlope Heritage Conservancy, in addition to small overlaps along the Project Area boundary with the Upper Kimsquit, Fiordland, K'ootz/Khutze, Europa Lake and Cascade-Sutslem Conservancies.

Inventory Information Sources

New and other data sources provide critical reference information, such as base mapping information, or other data that needs to be integrated 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") features
- Biogeoclimatic Ecosystem Classification ("BEC") Zones data
- Forest Health data
- 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 Aerial photography

Standards and Procedures and final deliverable formats that will be followed for the photo interpretation projects are as described in FAIB's Photo Interpretation Standards page:

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

Section 3 Project Specifications and Photo Interpretation Plan

Aerial Imagery

Digital frame camera imagery of the project area was acquired to GeoBC standards and specifications in the summer of 2019.

The following is the list of digital products supplied:

- 4-band 8bit RGBI digital frame imagery at 25 cm ground sample distance ("GSD");
- ISSD Z\I stereo project file in UTM NAD 83 projection;
- 50 cm RBG natural colour ortho-imagery;
- Photo index shapefile with image names and locations; and
- Flight line orientation of east-west and west-east.

Stages of VRI Photo Interpretation

A typical VRI project is divided into three stages which occur in succession: polygon delineation, field calibration and attribute estimation. Quality assurance is a component of each stage that occurs concurrently.

A project pre-work meeting is mandatory. The purpose of this meeting is to bring together the Ministry Project Manager, VRI Photo Interpretation Contractor 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 questions or issues before project work commences, and establish timelines for deliverables and data flow. Minor changes to the contract to complete the photo interpretation 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.

1. Polygon Delineation:
   Polygon delineation of aerial imagery is based on the BC Land Cover Classification Scheme ("BCLCCS"). This 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 based on vegetation attributes (i.e., treed versus non-treed), mensuration attributes (i.e., species, age, height, and crown closure), and ecological attributes where appropriate and as per standards in the VRI Photo Interpretation manual.

   Minimum interpreter-delineated polygon sizes will follow the delineation requirements in the VRI Photo Interpretation manual:

Polygon Type	Minimum Size
Polygons with distinct attribute differences that create obvious boundaries on the imagery (e.g., trees versus shrubs; immature trees versus mature trees)	≥ 2 hectare minimum
Polygons with indistinct attribute/boundary differences on the imagery (e.g., similar stand species and ages with a 5-meter height difference)	≥ 5 hectare minimum
Polygons designated as Alpine (i.e., high elevation, above tree line with less than 1% tree cover)	≥ 5 hectare minimum for individual cover types; otherwise, combine adjacent cover

	types into polygons ≥ 5 and describe using land cover component descriptions.

Table 6 Minimum interpreter-delineated polygon sizes

The Ministry will supply RESULTS opening data and FWA polygon features for direct incorporation into the VRI.

2. Field Calibration:
   Field data collection will be conducted on the project area by the VRI Photo Interpretation Contractor for the project area. This stage is called field calibration because it allows the photos interpreters to become familiar with the project area and collect tree data in different pre-identified polygons. This data helps calibrate the photo interpreters' knowledge of a variety of forest stand types for the subsequent photo interpretation of stand attributes.

   Field calibration data will include a combination of low elevation helicopter passes over stands of interest (referred to as air calls), and ground plots (referred to as ground calls) that are accessed by road or, in remote locations, by helicopter. Tree information and measurements including species, age, height, and basal area are collected.

   The Kitlope VRI project area is only accessible by boat or aircraft (helicopter or float plane); there are no roads or developed trails into the area. Because of the remoteness and inaccessibility, the field calibration stage will be focused on using air calls to collect most forest stand data. A smaller number of ground calls will be established where boat or air-access ground calls are possible.

   Approximately 739 air calls are planned for the Kitlope VRI project area. The number of air calls has been increased from the VRI field calibration standard of 20 air calls per FME, to a maximum of 30 air calls to be established per FME. This increase in number of air calls per FME is to ensure that sufficient forest cover data is captured by the Contractor during field calibration, given the limitations with ground access. There is a proportional reduction in the number of air calls per FME to reflect the percentage of area within each FME that falls within one of the non-treed alpine BEC zones.

   Because of the challenges and unpredictable nature of ground access, the ground calibration type used for this project will be one-point ground calls. A maximum of 100 - ground calls will be used for the entire project area.

   Air calls and ground calls may have modified procedures from the standards described in the *VRI Field Calibration Procedures for Photo Interpretation manual.* The VRI Contractor

is not permitted to establish field calibration plots in any areas where access has not been approved.

Prior to the initiation of a field calibration program, the VRI Contractor submits a field calibration plan to the Ministry for review and approval to ensure all identified issues are accommodated where possible. As part of the final project deliverables, the Ministry requires the delivery of a complete set of all new field calibration data sources in a digital format determined by the Ministry, including their geographical locations (e.g., UTM coordinates) and the complete set of field attribute data collected.

3. Attribution Estimation:
   VRI polygon attribution involves assigning descriptions that are either estimates of polygon characteristics (e.g., species, age, and height for treed polygons; shrub heights; ecological information) or contain other information relating to the polygon (e.g. disturbance history). Each polygon is uniquely identified, and subsequent qualitative and quantitative estimates are made for all vegetated and non-vegetated characteristics visible on the imagery for each polygon.

   Land cover types within the polygon that are too small to meet the minimum polygon size requirements may be described as a land cover component. Land cover components are used to identify the ecological function of the polygon or portions of the polygon

4. Quality Assurance:
   Quality Assurance ("QA") of all project stages is conducted by a party that is independent of the VRI Contractor performing the VRI photo interpretation and field calibration work. The QA auditor will be a 3rd party contractor or, in some cases, Ministry staff who are certified in photo interpretation. The QA auditor is present at the initial pre-work meeting held by the Ministry and VRI Contractor. QA must meet or exceed the *Vegetation Resource Inventory Photo Interpretation Quality Assurance Standards* on each stage of a VRI project.

Section 4 Project Scheduling and Implementation

The Kitlope VRI project will proceed from north to south and east to west with approximately 31.5 FMEs being completed in fiscal years 2023/2024 and 2024/2025. The new inventory will be available in 2026. This schedule may change to meet the Ministry's needs.

Fiscal Year	Activity
2022/2023	VPIP planning Contract Planning and Development

2023/2024	Contract Award Delineation Field Calibration Attribution
2024/2025	Attribution

Table 7 Proposed project schedule for the Kitlope VRI project.

A detailed delivery schedule outlining a progressive delivery of products will be set by the Ministry, in consultation with the VRI contractor, for each fiscal year.

Section 5 -Roles and Responsibilities

Ministry Project Manager

The Ministry project manager's responsibilities will be: project coordination; monitoring project progress; ensuring all contractors are qualified and certified; overseeing photo-interpretation activities; ensuring quality assurance is complete and delivered at each stage, authorizing payment and assisting in coordinating technical support where required.

VRI Contractor

The VRI Contractor works with the Ministry Project Manager to ensure the planning, coordination and execution of project activities are consistent with the VPIP and contract requirements. The VRI Contractor will ensure that there are a minimum of four interpreters to maintain data consistency. There will be one VRI certified photo interpreter to every non-certified photo interpreter if the latter are required for the project.

VRI Quality Assurance Contractor

Quality Assurance will be performed by either a 3rd party VRI Quality Assurance contractor or by Ministry personnel. Where a VRI QA contractor is utilized, the VRI QA Contractor will coordinate with the VRI Contractor and the Ministry to ensure that QA reporting meets the prescribed VRI standards. The VRI QA Contractor or Ministry Quality Assurance personnel is a VRI certified photo interpreter with a minimum of 10 years VRI experience and who is independent of the VRI contractor.