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# **Vegetation Resources Inventory**

Sunshine Coast TSA

VRI Project Implementation Plan

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Inventory Branch

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## Section 1 Introduction

### 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 specific operational activities associated with implementing and documenting an inventory project. It identifies areas for new photo interpretation, data sources, format of base files, project scheduling, deliverable expectations, etc. VRI photo interpreted inventories are produced by Ministry certified photo interpreters 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.

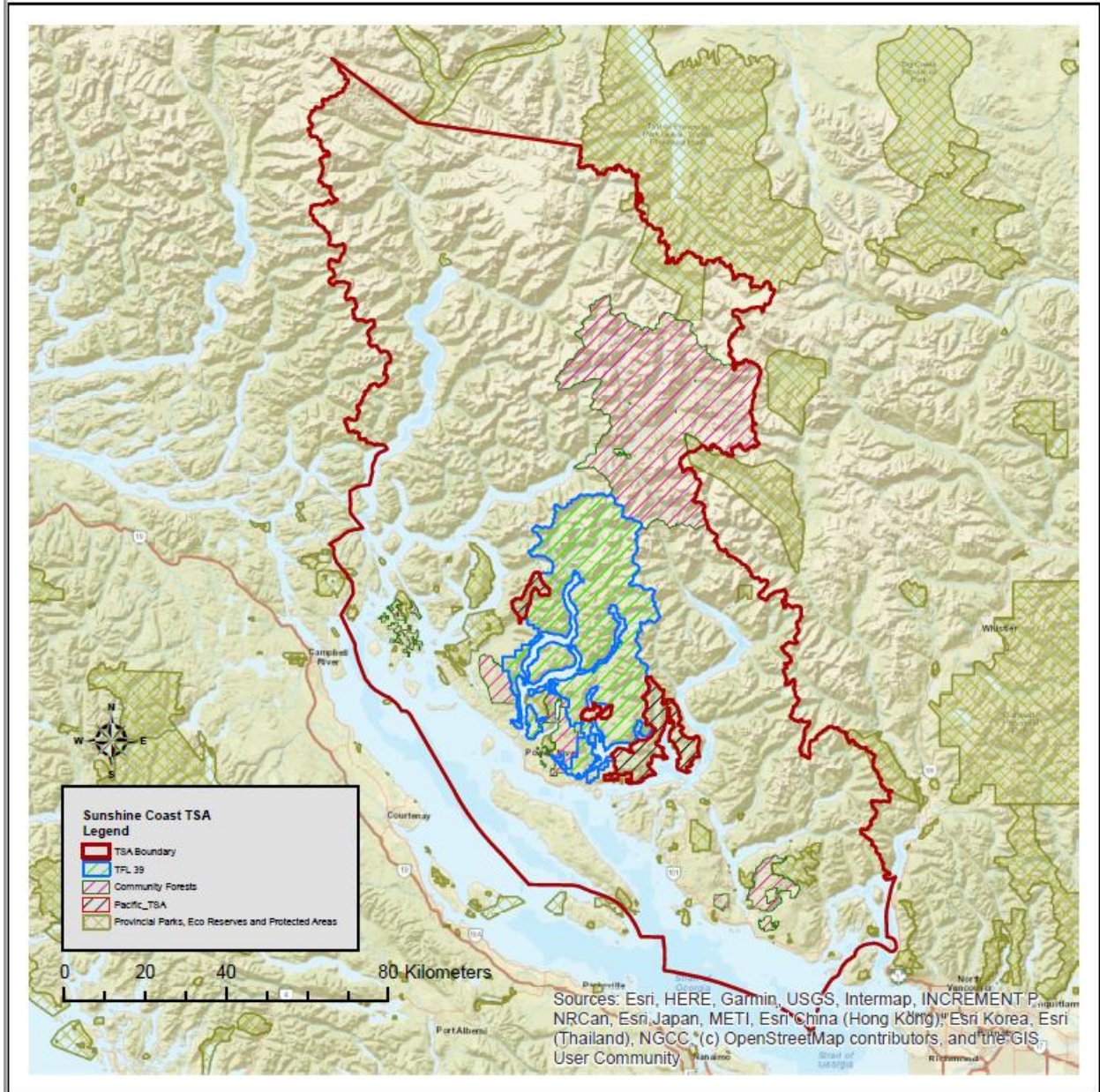
The Ministry has identified a need to complete a new VRI in the Sunshine Coast Timber Supply Area (“TSA”). A new VRI provides a strategic level planning inventory at the management unit level designed to answer two basic questions: where the resource is and how much is there.

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 cover using several 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 resource are managed and conserved sustainably.

### Background

The Sunshine Coast TSA comprises approximately 1.74 million hectares along the southwest coast of British Columbia (BC). The TSA is located 100 kilometres north of the City of Vancouver extending from Howe Sound to the head of Bute Inlet and is administered by the Sunshine Coast Natural Resource District office in Powell River. It is surrounded by the Soo TSA to the east, the North and South Island TSAs to the west, the Great Bear Rainforest South and Kingcome TSAs to the northwest, and the Williams Lake TSA to the north.

The Sunshine Coast is one of the natural resource districts developing a Forest Landscape Plan (FLP) for the FLP Pilot Project. The intent of the new FLP document is to replace the current Forest Stewardship Plan (FSP) as part of changes to British Columbia’s forest management regime. The FLP is part of a process of establishing clear objectives and outcomes for the management of forest resource values over a defined area. This new process will enable a consolidated approach to forest planning and management at the landscape-level and help to facilitate upfront collaboration between government, Indigenous Nations, and licensees, with input from stakeholders, communities, and the public. Figure 1 illustrates the Sunshine Coast TSA.



**Figure 1: Sunshine Coast TSA Boundary**

## Section 2- Photo Interpretation Plan

### 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.

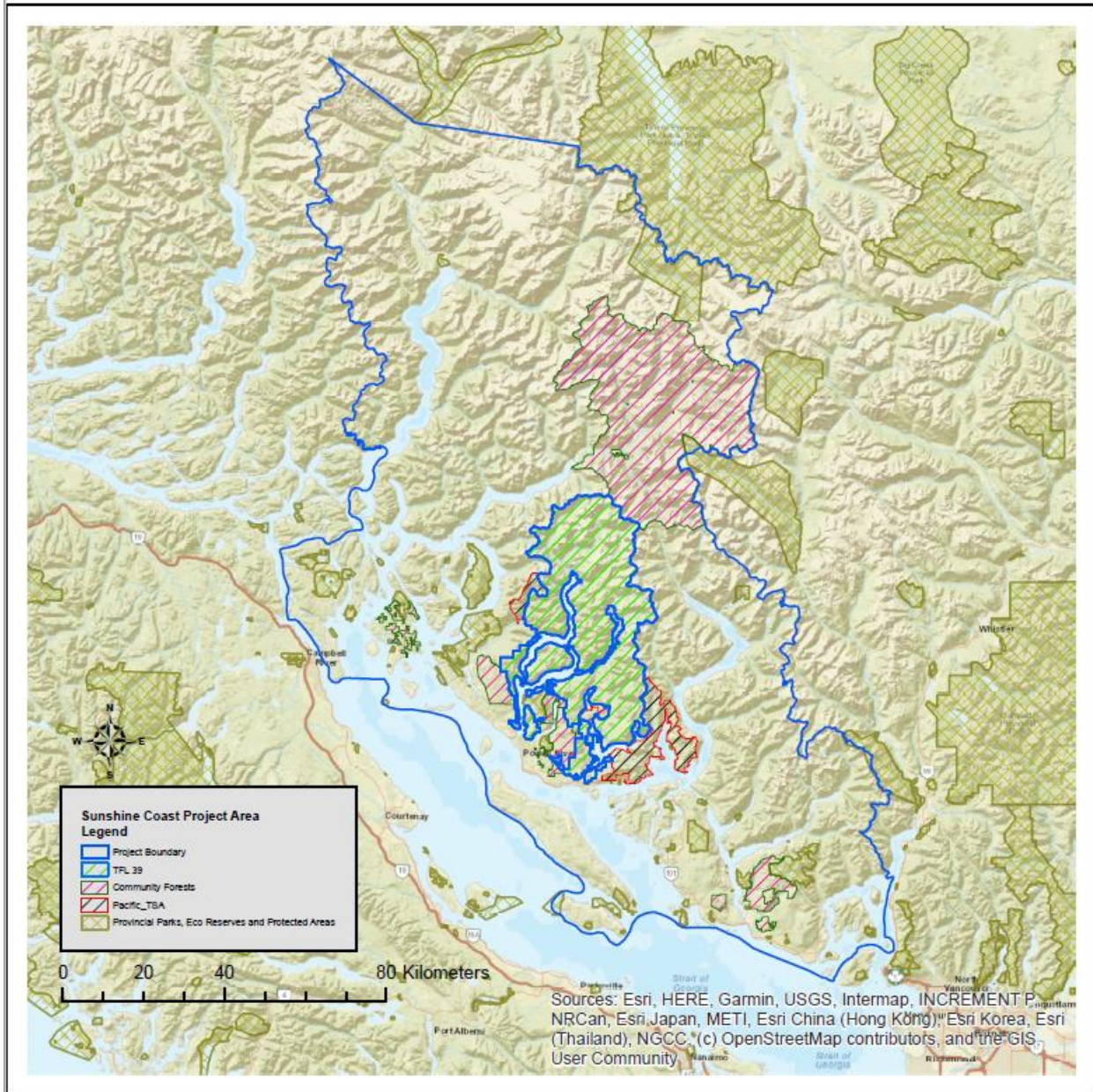
The overriding objective for the Sunshine Coast re-inventory project is to produce a new photo interpreted inventory to account for the accumulated change in the Sunshine Coast TSA since its last re-

inventory. The changes are attributable to many things including changes in tenure, 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. Since the TSA is part of the FLP Pilot Project, the inventory can be an effective tool in helping to facilitate the collaborative changes anticipated in the new planning document.

The new inventory will also provide much needed current information on the spatial distribution of live and dead stands, update species compositions to reflect and provide an estimate of significant (greater than 100 stems/ha) dead standing volume in the project area not captured in the previous inventory. Accuracy of vegetation cover descriptions will help habitat modelling (i.e. avalanche chutes for grizzly bears and tree species for avian nesting). As stated, updated species composition can help detect and reflect changes in forest health/ insect infestations - for example, Douglas-fir beetle, Hemlock looper, and Western Red Cedar dieback.

### Inventory Project or Area

The new Sunshine Coast VRI project area boundary will not match the Sunshine Coast TSA boundary. Areas that will be excluded from the re-inventory are TFL 39 and urban areas. Lasqueti Island and Quadra Island will be incorporated into the Sunshine Coast VRI project area to ensure seamless integration with the recently completed North Island VRI. The project boundary has been buffered so that it may tie into adjacent inventories where appropriate and to avoid any data gaps and overlaps caused by discrepancies between administrative data sources. The Sunshine Coast VRI project area contained primarily within the Sunshine Coast TSA and covers approximately 1.74 million ha, equivalent to 110 BCGS Full Map sheet Equivalents ("FME") based on 15,800 ha per FME. The project will include Quadra Island, Texada and Lasqueti Islands. Figure 2 illustrates the Sunshine Coast VRI project area.



**Figure 2: Sunshine Coast VRI Project Boundary**

The Sunshine Coast VRI project area is populated mainly by the communities of Powell River, Sechelt, Gibsons and Roberts Creek, along with several communities on the islands of Texada and Cortes. These populations influence the surrounding landscape and land uses with areas identified as private lands, protected watersheds, community forests, agricultural lands, various reserves, Indian reserves, provincial parks/recreation zones, and protected wildlife and ecosystem areas. These identified areas will be included in the photo interpretation portion of the Sunshine Coast VRI project area, but some or all may be excluded from any field calibration sampling. Table 1 summaries the identified land uses by category.

<b>Biogeoclimatic Zones</b>	<b>Area (Ha)</b>	<b>% of Project Area</b>
Coastal Western Hemlock (CWH)	904,229	52
Coastal Mountain-heather Alpine (CMA)	512,518	29.4
Mountain Hemlock (MH)	231,672	13.3
Coastal Douglas-fir (CDF)	85,661	5.0
Engelmann Spruce -- Subalpine Fir (ESSF)	2,681	<1
Interior Mountain-heather Alpine (IMA)	1,862	<1
Boreal Altai Fescue Alpine (BAFA)	220	<1
<b>Total</b>	<b>1,738,869</b>	<b>100</b>

**Table 1- Sunshine Coast VRI Biogeoclimatic (BEC) Zones**

<b>Leading Species</b>	<b>Area (ha)</b>	<b>% Current Known Inventory</b>
Hemlock (H, HM, HW)	303,569	40
Fir (FD, FDI)	257,558	34
Balsam (B, BA, BL)	74,126	9.8
Cedar (CW, YC)	53,799	7.1
Deciduous (DR, AT, ACT, RA)	51,952	6.8
Pine (PL, PLI)	9,766	1.3
Spruce (S, SS, SE, SX, SW)	2,841	<1
<b>Leading Species Subtotal</b>	<b>753,611</b>	<b>100</b>
Ocean	280,993	
Rock/Ice – (Alpine)	616,015	
<b>Non-Vegetated Subtotal</b>	<b>897,008</b>	<b>52</b>
Non-Alpine Land Area	841,861	48
<b>Total Project Area</b>	<b>1,738,869</b>	<b>100</b>

**Table 2- Land Use Categories summarized by total area in hectares within the Sunshine Coast VRI Project Area**



Primary Land Use	Area (ha)
Private Land	65,548
TFL 39 excluded	- 140,339
TFL 43 included	5,405
Provincial and Municipal Marine Parks, Eco Reserves	61,100
Community Forest (Schedule B)	190,447
Indian Reserves	3,161
Community Watersheds	15,203
Woodlots (Schedule A & B)	7,479
Ungulate Winter Range (Mountain Goat)	65,353
Timber Licence	441
Federal – Dominion government Block/Federal Parcels	295

**Table 3- Land Use Categories summarized by total area in hectares within the Sunshine Coast VRI Project Area**

#### 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 with 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 road feature
- Biogeoclimatic Zone (BEC) 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 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 photo standards and specifications in the summer of 2020. The following is the list of products supplied:

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

### Stages of 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 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 mensuration attributes (i.e. species, age, height and crown closure), and ecological attributes where appropriate.

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

<b>Polygon Type</b>	<b>Minimum Size</b>
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.

## 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 photo 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 or boat. Tree information and measurements including species, age, height, and basal area are collected.

The field calibration program will typically establish a minimum of 10 ground calls and 20 air calls per 15,800 ha (approximately 1 FME). The ground calls will be a combination of 1-point and 3-point ground calls. 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*. It is expected that 80% of the ground call calibration points will be non-truck accessible and require air access helicopter support.

The northern portion of the Sunshine Coast VRI project is covered by vast areas of alpine rock and ice. Due to the extensive nature of this non-vegetated designation the number of ground calls and air calls will be adjusted down in these areas. Approximately 1,172 air calls and 560 ground calibration calls are planned for the Sunshine Coast VRI project area. The number of air and ground calls will be maintained to the VRI field calibration standard target of 20 air calls per and 10 ground calls FME, to be established in the non-alpine areas of the project, while, an additional 106 air calls (10%) will be distributed to the areas with rock and ice designations (non-treed alpine BEC zones) and those areas in the transition zones not captured in the previous inventory. In addition to the air calls, there will be 27 ground calibration points (5%) distributed to transitional sub-alpine zones not captured in the delineation of the previous inventory.

The Ministry and VRI Contractor will coordinate with BC Parks to establish standards around accessing their designated areas. A 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:

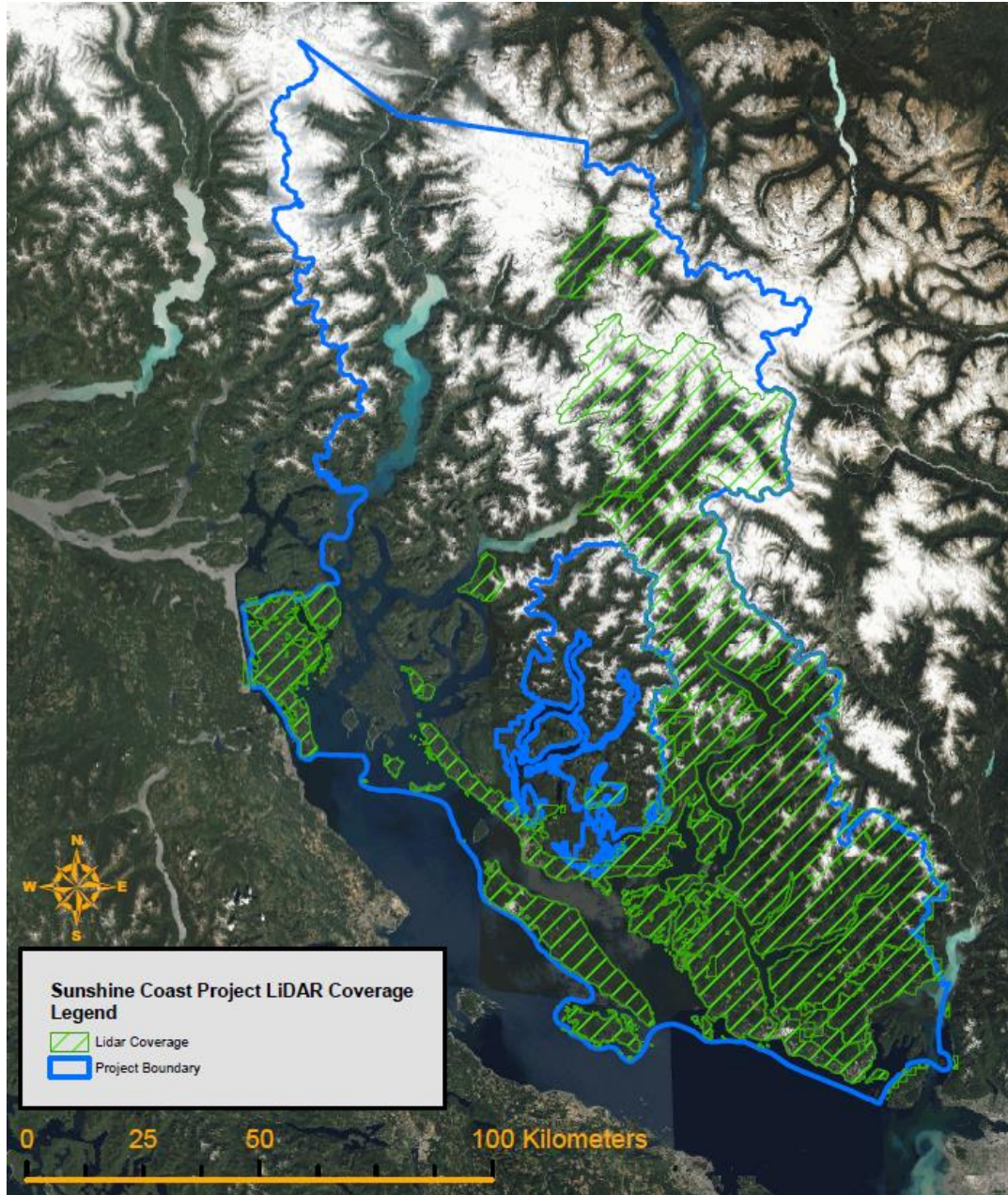
Quality Assurance (“QA”) of all project stages is conducted by a party that is independent of the VRI Contractor performing the VRI photo interpretation and field calibration work. The QA auditor will be a 3<sup>rd</sup> party contractor or, in some cases Ministry staff, who are VRI certified photo interpreters. 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.

5. LiDAR:

The Sunshine Coast VRI has partial coverage of the TSA covering approximately 687,185 ha.

Acquisition Year	Area (ha)
2015	22,079
2016	26,716
2017	13,338
2018	3,803
2019	621,249
<b>Total Area</b>	<b>687,185</b>

**Table 4. LiDAR Acquisition Year and Coverage (Ha)**



**Figure 3: LiDAR coverage within the Sunshine Coast VRI project area boundary**

To aid interpreters with attribution, the Ministry will supply a lidar derived sample of individual tree heights for areas with available lidar coverage within the project boundary (See table and figure above). The data will consist of three individual positions and heights on a 100m grid, the three trees are selected from a 20m radius of the grid location. The sampled trees retained are those whose heights are closest to the three height quartiles (Q1:25%, Q2: 50%, Q3:75%), given the 20m radius neighborhood. The 3D shapefile has the elevation of the treetops assigned to the z-value and is projected to UTM zn10, (EPSG: 3157). The shapefile attribute table is populated with the treetop elevation (DSM), the ground elevation (BEM) and an individual tree height value (L\_Tree\_HT).

**Section 4- Project Scheduling and Implementation:**

The **Sunshine Coast VRI project** work will proceed from south to north and east to west with approximately 30 FMEs being completed in fiscal year 2023/2024. The new inventory is expected to be available in 2025. This schedule may change to meet the Ministry’s needs.

Fiscal Year	Prime Activity
2022/2023	VPIP Planning Contract Planning and Development Contract Award
2022/2023	Delineation 30 maps
2023/2024	Field Calibration Southern Half Attribution
2024/2025	Delineation 82 maps Field Calibration Northern Half Attribution Contract Evaluation

**Table 5. The proposed project schedule for the Sunshine Coast EAST Inventory project.**

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

## 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 as required;
- 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 4 interpreters on the project to maintain data consistency. There will be one VRI certified photo interpreter for every non-certified photo interpreter if the latter are required for the project.

### **VRI QA**

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