Vegetation Resources Inventory

Field Calibration Procedures for Photo Interpretation

Prepared by

Ministry of Forests

Forest Analysis and Inventory Branch

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For questions concerning the content of this publication, please contact:

Manager, Forest Inventory
Forest Analysis and Inventory Branch
PO Box 9512, Stn Prov Gov't
Victoria, BC V8W 9C2
Phone: (778) 974-5612 Fax: (250) 387-5999

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Major Changes to Field Calibration Procedures

1. Summarized the data collection requirements for ground calls (Section 2.2.4).
2. Added the requirement for Quality Assurance to select 5% of ground calls proportional to the combination of ground call type (i.e., XGV-3, XGV-1, XGO) and access method (i.e., ground, air, water) as established by the contractor (Appendix C, Part 6).

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1.0 Introduction

Vegetation Resources Inventory (VRI) field calibration consists of ground and air assessments conducted by photo interpreters on vegetated polygons. They are intended to provide calibration information for subsequent photo interpretation by the individuals conducting the field visitations and to provide the photo interpreter with an iterative educational process to further increase their knowledge of the different vegetation types and site conditions in the project. Comprehensive land cover information is obtained through a detailed data-gathering routine. The data provide a useful link of vegetation attributes on the ground to how it is observed on aerial imagery and thus aid in providing accurate and consistent attribute estimation.

Proper location and establishment of VRI calibration points is imperative to providing useful data sources for the current inventory and any subsequent inventories.

The following principles apply to the placement of VRI calibration points:

- The collection of field calibration data must be distributed to cover the full range of anticipated land cover types to be observed, as well as areas identified as issues and of concern to the photo interpreter. Priorities for data collection may be identified on a project-by-project basis as per the project pre-work or Vegetation Project Implementation Plan (VPIP).
- Calibration points are conducted to provide data to strengthen the final photo-interpreted estimates.

The following are general requirements for calibration points establishment:

1. All photo interpreters involved in the attribution stage of the project must participate in collecting air call and ground call data to enhance their knowledge of the different stand types and conditions within the project area. All photo interpreters working on the project are expected to complete a percentage of fieldwork in similar stand types that is comparable to the percentage of attribute estimation they are responsible for.
2. Collection of calibration data is to be conducted by a certified VRI photo interpreter, or under the direct supervision of a certified VRI photo interpreter.
3. Before field visitation, the photo interpreter should observe the calibration point polygon through stereoscopic vision and make preliminary estimates for all attributes. Following the data collection, the interpreter should review the initial estimates in comparison with the data obtained.

Attributes descriptions provided in this document are defined in the VRI Photo Interpretation Procedures.

2.0 Calibration Points

There are three types of calibration points:

1. Observation
2. Ground call
3. Air call

Observations are not subject to the third-party Quality Assurance process. Ground calls and air calls are subject to the third-party Quality Assurance process.

2.1 Observation

Ground and air observations (XO) are integral and highly useful data sources for the photo interpreter. Efforts should be made to collect and record data while traveling between ground call and air call locations. All ground and air observation information can be collected on existing photos or orthoimages.

The location of observations is determined during the calibration process and is dictated primarily by the photo interpreter's need for additional calibration data in difficult forest types and can be as simple as a notation of species composition or height estimate in a polygon.

2.2 Ground Call

There are three ground call types that are considered acceptable for the collection of ground data for calibration purposes; 3-point ground calls, 1-point ground calls and observation ground calls. The types and number of ground calls established will vary by project and will be specified in the VPIP or project contract. It is expected that projects will use a combination of the three types of calls.

The proportion of each type of ground call is determined at the project planning stage. The lead proponent or licensee should consider the following factors when deciding on the proportions of each type of call: the complexity of stands (uneven-aged, multi-species, variable heights, and variable density), age and distribution of previous data sources, and fieldwork budget.

The photo interpreter must review the plot results before leaving the ground call (particularly in multi-species stand) and comment on whether the plot data reasonably reflects the observed stand attributes. Based on an ocular observation of the representative portion of the stand, the interpreter should comment if a species composition adjustment is necessary to the species composition derived from the plot data. A comment regarding species composition adjustment is entered in the comment section of the final ground call digital summary.

Three Point (3-point) Ground Call (XGV-3)

The 3-point ground call consists of three plots with a minimum distance of 50 m between each plot. A reduction in the minimum distance is permitted in very small polygons. This type of ground call is typically used in complex stands with significant variation in stand attributes. For example, these include stands with multiple species, patchy tree distribution; uneven-aged or all-aged stands; multiple layers such as interior Douglas-fir stands; and a wide range of ages and/or heights such as mature spruce-balsam complexes. The 3-point ground call will provide more representative information on species composition, basal area, density, age, and height in these types of stands than a 1-point ground call.

One Point (1-point) Ground Call (XGV-1)

The 1-point ground call consists of one plot established in a representative portion of the polygon. This type of ground call would typically be used in very homogenous polygons with little variation in tree attributes. Fire origin stands of lodgepole pine or stands of coppice aspen are good examples of where a 1-point ground call should be used. Complete a minimum of two informal prism sweeps in representative portions of the polygon to determine an appropriate prism size before the establishment of the plot center. Informal sweeps are not subject to Quality Assurance.

Observation Ground Call with Measurement (XGO)

The establishment of observation ground calls with measurement is an integral and highly effective calibration technique. Like the 1-point ground call, the observation ground call is typically used for homogenous polygons with minimal species and height variation.

The use of observation ground calls is restricted to polygons with a species composition that includes only a single major leading species. A brief walk-through of the polygon area must be completed to confirm the species composition. When there is any doubt if the polygon is a single major leading species, it is recommended that a few informal sweeps be completed.

The mandatory attributes to be collected during the observation ground call are an ocular species composition estimate, and the age and height of the leading and second species. Additional comments may also be collected in the field to help the photo interpreter with the estimation phase.

Collect and record the coordinates of the leading species sample tree, hang flagging tape on the leading species sample tree, and provide the azimuth and distance to any second species sample tree.

During the Quality Assurance process the use of count plots by the auditor to verify the accuracy of the ocular species composition estimate is permitted.

2.2.1 General Requirements for Ground Call Establishment

All photo interpreters involved in the attribution stage of the project must participate in the ground calibration to enhance their knowledge of the different stand types and conditions within the project area.

Ground call data collection is to be conducted by a certified VRI photo interpreter, or by someone under the direct supervision of a certified VRI photo interpreter.

Ground calls must be located in representative areas of the polygon.

Locate all ground call plots a minimum of 50 m from any distinct boundary to reduce the possibility of edge effect. In hilly or mountainous areas, establish plots within a 3-point ground call perpendicular to the terrain to capture variability. These boundaries can include, but are not limited to, the edge of road rights-of-way, cut blocks, well sites, swamps and water features. A reduction in the minimum distance from a defined polygon boundary may be permitted in small polygons where the 50 m distance requirement cannot be met for a 1-point ground call or ground observation with measurements, or the 100 m distance requirement for a 3-point ground call cannot be met.

Tree measurement and recording of data should be systematic in nature (clockwise from north); at a minimum, the first tree measured in each plot should be numbered, and all trees tallied 'in' should be marked with a paint dot or number at or near DBH.

To assist with the identification of plot trees and measurement of borderline trees, plot centers should consist of stakes firmly embedded in the ground with a ribbon around it and the plot number on the ribbon and, if it is a 3-point call, the point number (saplings and small trees are not acceptable).

Use flagging tape to indicate the tie point and the direction of travel to the plot centre and in between plots.

Before leaving the ground call, the photo interpreter must complete all measurements, calculations and data summaries. The photo interpreter should carefully consider the data summary as it relates to the ecology and vegetation of the site before leaving the polygon.

Tree count will be based on the measurement of the dominant, co-dominant and high intermediate trees in each layer in the polygon.

For multi-layer stands, complete information is to be collected and recorded for each layer visible on the aerial image. The field crew should stereoscopically view the polygon prior to collecting any data to determine whether multiple tree layers exist within the polygon and identify these in the field plan. When there is more than one layer, the interpreter must write down in the column next to the tree number column on the field card which layer each tree belongs to.

An observed or calculated dead layer consisting of 100 snags or more, is considered a separate layer and will require a tally of all trees and sample trees on the leading species.

An ocular species composition must be estimated for each ground call, and the interpreter must comment if a species composition adjustment is necessary to the species composition derived from the plot data. A comment regarding species composition adjustment is entered in the final ground call digital summary.

2.2.2 Plot Types

Variable Radius Plot

A variable radius plot should be used in stands where the average DBH is > 10cm.

The desired tree count is 6 to 8 live dominant, co-dominant and high intermediate trees per variable radius plot **on average over the project area**. Once a BAF is selected, it will be maintained throughout all of the plots in that polygon. There are open forest stands in the province that will not achieve the target minimum on an individual call.

Borderline trees will have the diameter and horizontal distance measured to determine whether they are 'in' or 'out.' This data should be recorded on the field cards to assist with Quality Assurance.

Fixed Radius Plot

Fixed radius plots can only be 3-point ground calls.

Fixed radius plots should only be used in stands where the average stand diameter is ≤ 10cm DBH.

The optimum plot radius used should result in an average of 6 to 8 live trees per plot and must use one of the following plot radiuses: 5.64 m, 3.99 m, 2.52 m or 1.78 m.

The plot size shall be maintained consistently for all fixed radius plots within the polygon.

All trees within a circular plot must be tallied and used in all tree calculations and measurements. Splitting of plots or using only a portion of a circular plot to make attribute measurements is not permitted.

2.2.3 Sample Tree Selection

Sample trees must be representative of the main canopy of the stand, typically the co-dominant and dominant trees for each layer. Trees should be free of MAJOR defects, including:

- Significant broken top
- Significant dead top
- Fork or crook that significantly affects height growth
- An abnormally high amount of scarring or other damage that may have affected height growth (e.g. significant mistletoe infection).

Significant refers to a reduction in the length of the tree compared to what it would be if undamaged. This is a subjective assessment without any defined percent height loss requirement. When the sample tree appears shorter than the majority of the other plot trees from the same cohort (species, crown class, diameter class, general age), then it would not be a suitable tree.

Select at least one sample tree for age and height measurements for both the leading species and second species. When using a 3-point ground call, three leading species trees and one second species tree must be selected over the three plots. A second species sample tree must be chosen for any composition equal to or greater than 1% as indicated in the final plot label.

The ocular species composition was introduced primarily to capture the polygon minor species which in some cases is not captured in the ground call tree tally. In a situation where the ocular species composition of the first and second leading species is different from the ground call mathematically calculated species composition, additional sample trees that meet the sample tree requirement for the ocular species composition must be collected.

Multiple layer polygons will have a 3-point ground call with three sample trees of the leading and at least one of the second leading species for the tallest live layer with more than 10% crown closure, and one of the leading and one of the second for each of all other live layers. When no layers have over 10% crown closure, collect three sample trees of the leading species and at least one of the second leading species from the tallest layer, and other layers still require sample trees as described above.

Dead layers require the collection of age and height data for a single sample tree of the leading species. When the interpreter is unable to obtain a suitable age/height pair from a dead tree, they must take a comparable age/height from a live tree of the same species. A dead tree must be attempted prior to selecting a comparable live tree as an alternate.

The same trees must be used for both age and height. Where sound sample trees are not available, trees with rot defects may be sampled.

All sample trees are to have an 'S' painted on them, facing the direction that the height was taken.

When there are no representative 'in' trees available, trees from outside the plot may be used as sample trees. Number all external sample trees, starting with 99 for the first sample tree, 98 for the next sample tree, etc. This sequence of numbering should be continued until all sample trees have been identified. A comment should be noted on the field card indicating the approximate bearing and distance from the plot center to the sample tree to assist the Quality Assurance personnel in locating the sample tree(s).

2.2.4 Data Collection

The following table summarizes the data collection requirements for ground calls.

Attribute	XGO	XGV-1	XGV-3
Call Number	◆	◆	◆
Number of Points		1	3
BAF	◆	◆	◆
Tree Numbers		◆	◆
Tree Species	◆	◆	◆
Live/Dead Indication	◆	◆	◆
Tree Layer (e.g. 1, 2, D)	◆	◆	◆
Diameters at Breast Height (DBH)	+	++	++
Crown Class		◆	◆
Species Composition (Calculated)		◆	◆
Species Composition (Ocular)	◆	◆	◆
Leading Species Age	1	1	3
Leading Species Height	1	1	3
Second Species Age	1	1	1
Second Species Height	1	1	1
Snags		◆	◆
Location Coordinates with GPS	◆	◆	◆

◆ Mandatory

+ For XGO: measure sample tree diameters

++ For XGV-1 and XGV-3: measure sample tree diameters and measure or estimate non-sample tree diameters.

The following contains additional information regarding the collected data in the table above, along with ancillary information also required for each ground call:

- Call number
- Site access methodology (truck, helicopter, etc.) and access issues comments

- Project name
- Call type (i.e. XGV-1, XGV-3, XGO)
- Date
- Crew member names or initials
- Location (i.e. Coast or Interior)
- Azimuth(s) and distance(s) from the tie point to the first data collection point and all subsequent points
- Basal Area Factor (BAF) or radius
- Types of points within the call (i.e. measure or count)
- Location coordinates are recorded in a UTM NAD 83 format. When unable to capture coordinates with a Global Positioning System (GPS) unit, record the intended coordinates and label them as "Intended" coordinates. Label coordinates captured in the field with a GPS unit as "Field" coordinates.
- Record the genus and species for all tallied trees.
- Tree layer
- Diameter at Breast Height (DBH): Record the DBH for all tallied trees. Refer to the VRI Ground Sampling (Phase II) Procedures manual for procedures and examples of DBH measurements.
- DBH source value (i.e. measured or estimated)
- Height: Measure the height of all sample trees
- Crown Class: Identify the crown position of each tallied tree in relation to the surrounding stand structure within approximately 25 m of the extent of the call. In the case of a two-layered stand, identify a tallied tree's crown position in relation to the layer it represents.

    Category I - Dominant (D), Co-dominant (C), High-intermediate (H)

    Category II - Intermediate (I), Suppressed (S)
- Age measure code when pith cannot be reached (e.g., ROT, CRC, etc.)
- Age: Collect an age core from all sample trees. Field count all collected age cores. Office-verify all collected age cores using a hand lens or microscope. Record the length and ring count of the sound wood portion to support the total age calculation when the tree centre is rotten or the tree is too large to reach the centre. Sample trees with prorated ages are not subject to the Quality Assurance standards. Keep all collected age cores for possible office re-verification and Quality Assurance purposes. Record the missed years to the pith.

- Azimuth: Record the azimuth and distance from the plot centre to all external (e.g. #99) sample trees
- Face/Centre: For every borderline tree, indicate if the tree was measured to the face or centre.
- Distance: For every borderline tree, record the slope distance and slope from the plot centre.
- Ecological Information:
    - Record the site position meso (SPM), dominant soil moisture regime (SMR) and dominant soil nutrient regime (SNR) in the area of each ground call.
    - For a 1-point ground call, determine the dominant SMR and SNR within a 25 m plot radius.
    - For a 3-point ground call, determine the dominant SMR and SNR within a 20 m strip of the ground call transect.
    - The crew is encouraged to correlate the presence of all vegetation species (trees, shrubs, and herbs) with soil types and their moisture and nutrient regimes.
- Shrub, herb, bryoid and non-vegetated cover: Record the type and percent cover when those features are potentially visible in the imagery.
- Ocular Species Composition: Estimate in a representative area of the polygon stand for every ground call and record it separately in the comments section.

2.2.5 Data Summary

Summarize each ground call and include the following data at a minimum:

- BCGS map sheet number
- Project name
- Crew member initials
- Company name
- Call number
- Call type
- Call year
- Number of points
- Ocular species composition
- Layer ID

- Species composition: Species composition is determined on the basis of the basal area of the Category I crown class trees (D, C, and H). For variable radius plots, species composition is based on the tree count. For fixed-radius plots, compute the composition percentages using the individual tree basal areas.
- Age: The average age of the leading and second species is based on the office-verified sample tree measurements.
- Height: The average height of the leading and second species is based on the sample tree measurements.
- Basal area: Record in m^2/ha. When the interpreter feels that the tallied trees do not reflect the polygon's actual basal area of the stand, an estimate of the basal area should be made in the comments section.
- Density: Record in stems/ha. Calculate density using the methodology on the VRI field cards or with a formula accepted by the Ministry.
- Snags: Record in snags/ha. When snags are ≥100 stems/ha, identify a Dead Layer as a separate layer and capture all the necessary attributes (i.e. species composition, leading species age and height, density, and basal area).
- Shrub height and crown closure
- Herb type and percent cover
- Bryoid percent cover
- Non-vegetated cover type and percent cover
- Site position meso, soil moisture regime and soil nutrient regime
- Comments: Add comments that help describe the polygon to assist the interpreter during the attribute estimation phase.
- Coordinates: For a 3-point ground call, the centre point coordinates are used as the reference. When required for a project or at the interpreter's discretion, GPS-captured data may also be collected at the start-point and end-point of a multi-point call and recorded in the calibration tile.

2.3 Air Call

Preliminary planning includes the creation, submission and approval of a field air calibration plan, including a tally of air call targeted stand types. In this respect, initial polygon delineation for a project should be completed prior to the determination of field calibration locations.

All information collected will be recorded in a spreadsheet format in the order listed in section 2.3.1 below. A hardcopy version must be made available to the Ministry and Quality Assurance personnel for auditing purposes upon request. Summarized digital air

call data must be submitted to the Ministry in the current version of the Ministry Calibration spreadsheet.

2.3.1 General Requirements for Air Call Establishment

The Ministry requires a minimum of one BC VRI Certified photo interpreter in the aircraft during air call data collection, although it is preferable to have two certified interpreters.

Each interpreter should air call a proportional number of project area map sheets.

Locate air calls in representative areas of the polygon and cover a sufficient extent of the polygon to capture each polygon's diversity.

Capture all air call start, mid, and end-point locations with a GPS unit to facilitate reestablishment if they are subsequently revisited for any Quality Assurance work and accurate placement in the provincial field calibration tile. Positions for the start, mid and end points may be determined using the field plan, GPS-captured tracks or waypoints collected by the helicopter but must accurately reflect the location, orientation and extent of the air call.

Data collected in air calls should be for the visible portion of the polygon (trees that are visible on the aerial imagery used for the project, shrubs and herbs not otherwise obscured by taller vegetation, etc.) This would normally include trees in the dominant, co-dominant and high intermediate canopy positions.

Decisions about multi-layer stands are made using stereo images before going to the air call location. For multi-layer stands, collect and record complete information for each layer visible.

All of the data collected are to be estimates. It is important that the crews calibrate themselves with ground measurements to ensure the estimates are reasonable. The air call crew must set down to collect ground data approximately every 20 air calls (and indicate in the records where this has occurred) to enable them to calibrate their estimations.

2.3.2 Data Collection and Summary

All air call attributes are only based on dominant, co-dominant and high-intermediates crown class trees.

The following is required information is to be recorded for each air call:

- BCGS map sheet number
- Project name
- Crew member initials
- Company name

- Call number: Format air call numbers as: Flight plan number – Air call number – Year. Assign a unique number to each air call and number air calls sequentially for ease of reference.
- Date
- Species composition: Tree species composition is determined on a basal area basis and includes a maximum of six tree species. Each species indicated has a corresponding percentage.
- Age: Record the leading and second species ages to the nearest ten years.
- Height: Record the leading and second species average height to the nearest 1 m.
- Layer ID
- Basal area: Record in m^2/ha.
- Density: Record in stems/ha.
- Snags: Record in snags/ha. When snags are ≥ 100 stems/ha, identify a Dead Layer as a separate layer and capture all the necessary attributes (i.e. species composition, leading species age and height, density, and basal area).
- Coordinates: Capture all start, mid and end-point locations in a UTM NAD 83 format with a GPS unit.
- Comments: Add any comments that may assist the photo interpreter during the photo estimation phase.

Useful supplemental information is collected at the interpreter's discretion, especially in sparsely treed polygons:

- Shrub height and crown closure
- Herb type and percent cover
- Bryoid percent cover
- Non-vegetated cover type and percent cover

3.0 Documentation of Calibration Points

For all final located ground calls and air calls, the minimum documentation must include the location, the extent and identification of each call. For Quality Assurance purposes, an orthoimage showing field locations must be provided.

Ground Call

Upon completion of the ground call, the appropriate aerial photograph or orthoimage should be pin-pricked to mark the location of the ground call. The corresponding ground call documentation details should be noted near the location mark. A capture of the field coordinates for the plot centre must be carried out and recorded on the field card.

For example, documentation for a 3-point ground call (reference #3) established in 2008 is as follows:

GV 3(08)

I----------X----------I

Documentation for a single point ground call (reference #4) established in 2008 is as follows:

X GV 4(08)

Documentation for an observation ground call (reference #5) established in 2008 is as follows:

X GO 5(08)

Air Call

Upon completion of the air call, the appropriate aerial photograph or orthoimage should accurately mark the location of the call. The corresponding air call documentation details should be noted near the location mark. GPS captured coordinates for the start-point, mid-point, and end-point locations of the air call extent are required.

For example, documentation for an air call (call 21, flight plan 3) established in 2008 is as follows:

3-21(08)

|--------- X -------->

Any variation from the above requirements should be agreed to and documented during the project pre-work meeting. The photos or orthoimages and newly acquired ground call GPS-captured coordinates must be made available to the Quality Assurance personnel.

4.0 Deliverables

4.1 Interim Field Deliverables

The following deliverables are required to be provided to the Ministry and Quality Assurance personnel upon request. These may be required during the fieldwork stage in order to provide timely Quality Assurance results and feedback to field crews:

- A list of all air and ground calls completed to date, including call number, call coordinates, and crew members
- Copies of air call tally cards or digital equivalent (i.e. photographs of paper cards are accepted at this stage)
- Ground call field cards, paper forms or digital equivalent (in a format compatible with MS Excel, MS Notepad, or MS Word) containing all attributes that are required to be collected in the field as per the contract and this document.

Crews must be able to provide the above information on short notice (i.e. one or two days), as Quality Assurance personnel may be on-site and require data promptly.

4.2 Final Field Deliverables

The final deliverables submitted to the Ministry must include:

1. Air call tally cards or digital equivalent
2. Ground call tally cards (forms FS167A, B and C) or their equivalents (digital or paper) that include the same fields, including call coordinates
3. Summary of all ground calls and air calls data in a digital format provided by the Ministry that must include corrections from the Quality Assurance reports
4. A field calibration personal geodatabase file (including the same fields as the field calibration template) with the final location and the extent of established ground calls and air calls

Appendix A – Ground Call Standards

Critical Pass/Fail Standards

Critical pass/fail standards have been established for a number of Ground Call attributes. The ground call fails, and the batch is rejected when the standards are not met for any of these attributes.

Attribute	Rating Possible	Standards	Comments
Representative Location	Pass/Fail	Ground calls must be located within a representative portion of the polygon	An interpreter must ensure that a call is representative of the polygon. When it is clearly unrepresentative of the polygon (gross error), then the call will be rejected. (e.g., the calibration point is in a non-representative portion of the polygon).
Establishment Location	Pass/Fail	The physical location of each ground call plot must be within 10 m of the field-collected coordinates	This applies to each plot of a ground call.
Tree Count	Pass/Fail	1-point ground call: No errors allowed 3-point ground call: Within ±1 tree	Missed or extra trees are cumulative (i.e. one missed tree and one extra tree is a difference in tree count of two)
Species Identification	Pass/Fail	1-point ground call: Zero errors allowed 3-point ground call: One error allowed	

Scored Pass/Fail Standards

The Ministry has established pass or fail scoring standards for attributes not defined in the Critical Pass/Fail Attribute Standards above. Points are deducted when measurements are outside the required standard. When a given attribute is repeatedly measured or collected below standard, even in a single ground call or across multiple batches, the field crew may be required to revisit the batch(es) to ensure standards are attained. The call fails, and the batch is rejected when an audited call does not achieve 75% of the possible points.

Attribute	Points Possible	Standards	Comments
Layer Identification	1	No error allowed	Must correctly describe the number of layers
Crown Class	2	90% of the trees within the correct crown class category	
Age	2 - 8	Counted age < 300: within ±10% or 5 years, whichever is greater Counted age ≥ 300: within ±15% or 20 years, whichever is greater	Assign 2 points for each sample tree initially, and then deduct 2 points for each error
Height	2 - 8	Within ±5% or 0.5 m, whichever is greater.	Assign 2 points for each sample tree initially, and then deduct 2 points for each error
Diameter Breast Height (Sample Trees)	1	Within ± 3%	0.5 points deducted for each error to a maximum of 1 point
Diameter Breast Height (Non-Sample Trees)	1	Within ± 15% or 5.0 cm, whichever is greater	0.5 points deducted for each error to a maximum of 1 point
SMR and SNR	0.5	Within ±1 class	0.25 points assigned to each
Basal Area	1	Correctly calculated	Using interpreter's DBH values, Ministry-approved calculation formula and number of tallied trees
Density	1	Correctly calculated	Using the interpreter's DBH values, Ministry-approved calculation formula and number of tallied trees
Ocular Species Composition	3 1 0	≥ 80% correct ≥ 70 % correct < 70% correct	Species composition scoring guidance is provided below

Attribute	Points Possible	Standards	Comments
Suitable Sample Tree	1	1-point ground call: No errors allowed 3-point ground call: One error allowed	Must represent the crown position of the average dominant, co-dominant & high intermediate trees of each layer and be free of major defects.
Sample Tree Species	1	Must match the leading and second species of the ocular species composition	
Inter Plot Distance	1	≤ 10% of the project specifications	

Species Composition Scoring Examples

Each species match between the Quality Assurance personnel and interpreter is compared by percent (%) to calculate the percent correct for species composition.

Example 1:

Quality Assurance	$S_{40}Pl_{30}Bl_{30}$	
Interpreter	$Bl_{40}S_{30}Pl_{30}$	
Matching	$S_{30}Bl_{30}Pl_{30}$	30+30+30 = 90% match: 5 points

Example 2:

Quality Assurance	$Fd_{60}S_{20}Pl_{20}$	
Interpreter	$Fd_{85}S_{10}Pl_{05}$	
Matching	$Fd_{60}S_{10}$ Pl_{05}	60+10+05 = 75% match: 2 points

Example 3:

Quality Assurance	$Pl_{60}Fd_{30}Lw_{10}$	
Interpreter	$Fd_{55}Lw_{25}Pl_{20}$	
Matching	$Fd_{30}Lw_{10}Pl_{20}$	30+10+20 = 60% match: 0 points

Appendix B – Air Call Standards

Critical Pass/Fail Attribute Standards

Critical pass/fail standards have been established for a number of Air Call attributes. The air call fails, and the batch is rejected when the standards are not met for any of these attributes.

Attribute	Rating Possible	Standards	Comments
Mid-Point GPS-Captured Location Coordinates	Pass/Fail	Located in the correct polygon.	
Representative Location	Pass/Fail	Located within a representative portion of the polygon.	

Scored Pass/Fail Standards

The Ministry has established pass or fail scoring standards for the attributes not defined in the critical pass/fail standards above. Points are deducted when the measurement is outside the accepted standard. When it is found that a given attribute is repeatedly measured or collected below standard across multiple batches, the field crew may be required to revisit the batch(es) to ensure project standards are attained.

When an audited call does not achieve 75% of the possible points, the call fails, and the batch is rejected.

Attribute	Points Possible	Standards	Comments
Start Point and End Point Coordinates	2	Located in the correct polygon	1 point assigned for each correct coordinate set
Layer Identification	1	Must determine the correct number of layers in the stand, including any Dead layer	As would be seen in the photo A dead layer is $\geq$ 100 snags/ha

Attribute	Points Possible	Standards	Comments
Species Composition	7 4 0	≥ 80% correct ≥ 70% and < 80% correct < 70% correct	Species composition scoring guidance is provided above
Leading Species	6	Must be correctly identified	Either species is accepted as the leading species when the first and second species are within 10% by composition.
Age	2 or 1	Within ± 20% or 15 years, whichever is greater	Use discretion when stands > 300 years old Leading species age: 2 points Second species age: 1 point
Height	5 or 3	Within ± 15% or 3 m, whichever is greater	Leading species height: 5 pts. Second species height: 3 points
Basal Area	1	Within ± 20% or 10 m^2/ha, whichever is greater	
Density	1	Within ± 20% or 100 stems/ha, whichever is greater	
Snags	1	Within ± 20% or 100 snags/ha, whichever is greater	

Appendix C – Quality Assurance Procedures

This Appendix contains the Quality Assurance Procedures for ground call and air call establishment based on the VRI Field Calibration Procedures for Photo Interpretation. This document is intended to be used by individuals responsible for the Quality Assurance of the field calibration stage of VRI photo interpretation projects.

Quality Assurance is a process whereby the work is evaluated by assurance personnel using approved standards established for calibration point location and measurements. The Ministry has developed a rating system with pass or fail criteria to evaluate the audited calibration points and to determine if the calibration points were established to the current VRI standards.

The Quality Assurance results provide the contract administrator with information about the quality of the work being completed, and the contract administrator will use the pass/fail criteria as the basis for payment of work.

The ratings outlined in Section 4 and section 5 of this Appendix are used for the evaluation of the three ground call types and air calls as described in this document.

Systematic errors are reproduced inaccuracies that are made consistently in the delineation, attribution or field calibration stage over a project, portion of a project, or by a specific interpreter. These may be difficult to determine on an individual map basis.

An example of a systematic error would be where an interpreter has consistently missed calling D layers in beetle infected stands during the air call portion of field calibration. In this case, the Quality Assurance personnel may have noticed that an interpreter has missed one or two calls during the Quality Assurance flight, but it does not affect the overall pass or fail determination for air calls. In a Quality Assurance review of the air calls, it may become apparent that the missed D layer calls are more prevalent and are systematic (i.e. consistently being missed).

In instances such as this, the Ministry representative may require the interpreter to rework a portion or all of the calls, and they are subject to further Quality Assurance review.

1. Objectives of Quality Assurance

The objectives of conducting Quality Assurance of field calibration points encompass the determination of both the effectiveness of the calibration points and the accuracy of measurements.

Generally, the objectives are to:

1. Provide feedback for improving the effectiveness of field calibration and the quality of field data
2. Assess the performance of the individual interpreters

3. Ensure adherence to the specified Ministry ground call and air call establishment standards
4. Provide supporting information for contract administration (i.e. facilitate payment and document the quality for future use of the data)

2. Quality Assurance Process Requirements

Adhere to the following requirements during the Quality Assurance process:

1. Quality Assurance is performed by a Certified VRI Photo Interpreter with significant experience who is independent of the primary Contractor and sub-contractors that are undertaking the inventory project.
2. The Quality Assurance personnel is an experienced individual capable of conducting quality measurements and assessments to ensure field procedures have been conducted within standards.
3. The Quality Assurance personnel must be the person completing the Quality Assurance on all phases of the project, including the polygon delineation, field calibration and attribute estimation phases.
4. The project coordinator notifies the Quality Assurance personnel well in advance of the planned field start-up date. The initial Quality Assurance must commence in the early stage of field calibration work for each crew. The interpreters will benefit from and are encouraged to accompany the Quality Assurance personnel in the field, especially during the initial inspections. A second Quality Assurance visit must be completed once all the fieldwork has been completed to ensure the Quality Assurance sample includes the entire population of ground calls.
5. Send all third-party Quality Assurance reports to the Ministry representative.
6. Every ground call and air call established in the project, as well as every interpreter's work, must have a chance to be selected to undergo the Quality Assurance process.
7. Quality Assurance audit a maximum number of 50 air calls in a day.
8. The Quality Assurance ground call establishment must be carried out by a two-person crew. The Contractor's attendance during the field Quality Assurance measurements and review of air calls is strongly recommended however is not mandatory.

3. Procedures

The following are the general steps of the Quality Assurance process:

1. The Ministry designates the Quality Assurance personnel at the commencement of the project.

2. The Contractor and Quality Assurance personnel develop a schedule for submission of fieldwork and scheduling of Quality Assurance visits.
3. The interpreters complete the fieldwork and provide cards with supporting material to locate the calibration points to the Quality Assurance personnel.
4. The Quality Assurance personnel review calibration data and supporting materials in the office and select calibration points for a Quality Assurance review.
5. The Quality Assurance personnel prepare a Quality Assurance report and submit it to the Ministry representative.
6. The Ministry representative provides a report to the Contractor.
7. When required, a meeting is coordinated with the Contractor, Ministry representative and Quality Assurance personnel to review the report.

4. Data and Material Required

The interpreters must provide the Quality Assurance personnel with calibration data, air photos or orthoimages and any other supporting material that was used to locate the calibration points. This information will assist the Quality Assurance personnel in locating the samples. A list of the final GPS-captured coordinates of each calibration point must be provided. In addition, it is mandatory that all calibration points' locations are marked on the photos or orthoimages to enable points to be located without the assistance of GPS-captured coordinates.

5. Office Check

An office evaluation of ground call and air call data in the batch must be completed before the Quality Assurance personnel can proceed with the field inspection. When any of the data is missing, incomplete or errors are noted, the ground calls are returned for correction.

The Quality Assurance personnel assesses the distribution of established ground calls and air calls and provides comments in the Quality Assurance report on the distribution of the established calibration points versus the proposed distribution of calibration points in the approved Field Calibration Plan.

6. Calibration Point Sample Selection

A minimum of 5 or 5% (whichever is greater) of all calls established by call type must be selected for auditing. The geographic distribution of ground calls and air calls selected for Quality Assurance for each interpreter must represent the geographic distribution of ground calls and air calls established by that interpreter. When the geographic distribution of the air and ground calls selected randomly for Quality Assurance does not appear to match the distribution of the ground and air calls established by the interpreter, further discussion with the Ministry and a replacement selection of calls to Quality Assurance may be required.

When selecting ground calls for Quality Assurance, the Quality Assurance personnel will select and audit 5% of the ground calls in each combination of ground call type (i.e., XGV-3, XGV-1, XGO) and access method (i.e., ground, air, water). Round the number of selected ground calls in each combination up to the nearest whole number. The final number of ground calls audited in each combination must be within one call of this number.

For example, a field crew established 200 three-point ground calls, and 50 required air access. Therefore, Quality Assurance personnel must audit at least three of the 3-point ground calls that required air access, given that 50 × 5% = 2.5 calls and rounded up to 3 calls. Similarly, the field crew established 130 one-point ground calls, of which 30 required boat access. Therefore, Quality Assurance personnel must audit at least two of the 1-point ground calls that required boat access, given that 26 × 5% = 1.3 calls and rounded up to 2 calls. The following table illustrates the examples.

	Established	**5% QA**
3-Point Ground Calls		
Ground Access	140	7
Air Access	50	3
Water Access	10	1
1-Point Ground Calls		
Ground Access	60	3
Air Access	44	2
Water Access	26	2

Ground Call

Batches of ground calls will consist of 20 calls grouped by the lead interpreter and call type (XGO versus XGV) on the ground. Randomly select one call from each batch for Quality Assurance auditing.

Where safety or access restriction does not allow a ground call to be inspected, randomly select another ground call and document the reason for replacement on the tally card.

Air Call

Batches of air calls will consist of 20 calls in sequence by flight plan and lead interpreter involved in the air call data collection. Randomly select one call from each batch for Quality Assurance auditing. Typically, this will result in roughly one call per Full Mapsheet

Equivalent (FME) being audited, but actual numbers per FME may vary depending on flight plan layout.

7. Field Data Check

It is recommended that the original field crew accompany the Quality Assurance personnel in the early phase of the project. The following is a suggested process to follow during calibration point inspection:

Ground Call

1. Verify that the ground call location is:
    a. Within the representative portion of the polygon
    b. Accurately marked on the photo or orthoimage
    c. Within acceptable limits of the GPS-captured coordinates
2. Confirm that:
    a. There are adequate field markings of the tie point and tie-line
    b. The BAF size or plot radius was correctly selected
3. Check accuracy of:
    a. Plot tree count
    b. Tree measurements
    c. Sample tree selection and measurements
4. Provide comments on:
    a. Ocular species composition.
    b. Other matters the Quality Assurance personnel think the Ministry should know

Where a ground call cannot be found in the field, the Quality Assurance personnel collects GPS-captured coordinates and proceeds to check the next available ground call in the area.

Age Core Accuracy

It is expected that the Quality Assurance personnel will attempt to get as accurate an age as possible. On trees that are not rotten, Quality Assurance personnel must re-bore if it is estimated that they are missing more than two years of the core if less than 100 years old and five years if greater than or equal to 100 years old. Quality Assurance ages must be office-counted.

Borderline Trees

Measured borderline trees will be assessed as follows:

1. When the borderline 'in' or 'out' tree has been measured, and the original 'in' or 'out' status using these measurements has been correctly calculated (i.e. a distance from the plot center to the tree has been recorded, and the tree has been

calculated as 'in' or 'out' using the critical distance), the result will be accepted provided that the original critical distance calculated for the tree does not exceed one percent (1%) variation from the Quality Assurance measured critical distance, and the original horizontal distance measured for the tree does not exceed one percent (1%) variation from the Quality Assurance measured horizontal distance.

2. This applies to borderline tree measurements only.
3. The measured horizontal distance will be from the plot centre to the face of the tree at DBH, plus one-half measured diameter.

Air Call

1. Verify that the air call location is:
    a. within the representative portion of the polygon
    b. accurately marked on the photo or orthoimage
    c. within acceptable limits of the GPS-captured coordinates.
2. Check accuracy of:
    a. air call estimates

Where an air call cannot be found in the field, the Quality Assurance personnel collects GPS-captured coordinates and proceeds to check the next available air call in the area. Air calls that cannot be located by the Quality Assurance personnel score zero points on the air call rating form and are removed from the calibration data.

Calibration Data Transfer

Conduct a random 10% selection of air calls and ground calls and confirm that the calibration data transferred from the field cards to the calibration data summary table is completed correctly. The Quality Assurance results are based on the percentage of calibration points that are transferred free of any error for each batch of air calls and ground calls checked.

8. On-Site Reporting of Quality Assurance Findings

The preliminary Quality Assurance results must be presented to the Ministry representative as soon as practical following the field inspection.

In cases where the Quality Assurance is carried out while the interpreters are still at the project site, the Quality Assurance personnel must advise the interpreters on whether the completed work meets the standards and is acceptable prior to the Quality Assurance personnel's departure from the project site.

Where the Quality Assurance personnel identifies substandard work, remedial actions must be provided to the project coordinator prior to the interpreter(s) leaving the project site.

9. Dispute Resolution Process

Where a dispute arises between the photo interpreter and the Quality Assurance personnel, the Ministry representative is responsible for developing a mechanism to resolve the disagreements.

10. Quality Assurance Report

Feedback from the Quality Assurance personnel is important for the continual improvement of the calibration process and ground call establishment. The report should document any problems identified during the field review for the interpreter to be aware of areas of weakness to consider during the estimation phase and to improve ground data collection in the future.

Each Quality Assurance report must include the following:

1. Completed rating table (Table 1 and/or Table 2) for each batch (interpreter) of ground calls and air calls. For plot tree counts, Quality Assurance personnel must provide borderline measurements for any missed or added trees as part of report documentation.
2. Any observations and considerations data users should be aware of regarding the data collected
3. When required, a description of the recommended remedial action and a report on compliance with that direction
4. The Quality Assurance personnel's signature and recommendation of acceptance or not acceptance of the work
5. Air call tally cards or digital equivalent and Ground Call BC VRI tally cards (forms FS167A, B and C) or their equivalents must accompany the Quality Assurance report

As well as providing immediate feedback to the interpreters and Ministry, the results of the Quality Assurance process are included as part of the Project Completion Report deliverable.

11. Remedial Action Procedures

Where the outcome of the Quality Assurance identifies a need for rework, all ground calls in the affected submission must be revisited to correct the errors identified. Once the rework has been completed, a second Quality Assurance audit on the resubmitted ground calls will be required to ensure the work meets Ministry standards.

12. Ground Call Ratings

The ground call evaluation process assumes that all field cards are properly filled out, and ground call locations are documented on photos or orthoimages, as outlined in the ground call data collection procedures. When the tally cards are found incomplete or

ground call locations are not documented to the set standard, the batch submission will be returned to the interpreters for completion.

Note: For contracts where additional data will be collected as described in the Contractor's proposal or contract specifications above and beyond what is required by standard ground call data collection (e.g. ages, heights), a maximum of one extra sample tree in each plot for the ground call will be quality assured. Extra sample trees subject to Quality Assurance must be randomly selected and will be reflected in the scoring.

For example, a 3-point ground call with data collected for more than the standard four sample trees will be quality assured for up to three additional sample trees, with points assigned as per the ground call ratings. Maximum points cannot exceed 14 points per attribute and ground call.

13. Air Call Ratings

The air call evaluation process assumes that all air call data sheets are filled out, and air call locations are documented on photos or orthoimages, as outlined in the air call data collection procedures. When the data sheets are found incomplete or locations are not documented to the set standard, the batch submission will be returned to the field crew for completion.

Table 1 – Ground Call Quality Assurance Report

Project: Contractor: Batch Number:

Ground Calls in Batch: Ground Call Audited:

Critical Pass/Fail Standards

Attribute	Standard	**P**ass / **F**ail
Representative Location*	Located in a representative portion of the polygon	
Established Location*	Within + 30 m of the provided coordinate	
Tree Count	1-point ground call: No errors allowed 3-point ground call: Within ±1 tree Missed or extra trees are cumulative	
Species ID	1-point ground call: Zero errors allowed 3-point ground call: One error allowed	

* Only categories scored for ground observation with measurements (XGO)

Scored Pass/Fail Standards***

Num Layers	Sample Tree DBH	Est. DBH	Suitable Sample Tree	Crown Class	Age	Height	SMR/ SNR	Basal Area	Density	Ocular Species Comp.	Inter Plot Spacing **	Points Possible	Points Obtained	Rating (%)
(1)	(1)	(1)	(1 - 4*)	(2)	(2 - 8*)	(2 - 8*)	(0.5)	(1)	(1)	(3*)	(1)			

* Only categories scored for ground observation with measurements (XGO)

** Applicable to 3-point ground calls only.

*** See the VRI Field Calibration Manual for detailed standards

All Critical Pass/Fail Standards must be met. The Scored Pass/Fail Standards must achieve a 75% rating for the ground call to pass and the batch accepted. When a given attribute is repeatedly measured or collected below standard, even in a single ground call or across multiple batches, the field crew may be required to revisit the batch(es) to ensure project standards are attained.

Comments:

Interpreter: QA Personnel:

Date Audited: Pass/Fail:

Table 2 – Air Call Quality Assurance Report

Project: Contractor: Batch Number:

Air Calls in Batch: Air Call Audited:

Critical Pass/Fail Standards

Attribute	Standard	**P**ass / **F**ail
Representative Location	Located in a representative portion of the polygon	

Scored Pass/Fail Standards*

Field Coords	Num Layers	Species Comp.	Leading Species	Leading Age	Leading Height	Second Age	Second Height	Basal Area	Density	Snags	Points Possible	Points Obtained	Rating (%)
(2)	(1)	(7)	(6)	(2)	(5)	(1)	(3)	(1)	(1)	(1)			

*** See the VRI Field Calibration Manual for detailed standards

All Critical Pass/Fail Standards must be met. The Scored Pass/Fail Standards must achieve a 75% rating for the ground call to pass and the batch accepted. When a given attribute is repeatedly measured or collected below standard, even in a single ground call or across multiple batches, the field crew may be required to revisit the batch(es) to ensure project standards are attained.

Comments:

Interpreter: QA Personnel:

Date Audited: Pass/Fail:

Appendix D – Field Calibration Plan Procedures and Standards

Procedures:

Field Calibration Plan Objectives

A Field Calibration Plan (FCP) is required to ensure consistency between the proposed field calibration points and the requirements for additional information in the project area based on:

1. Data source analysis from previous inventories, which is conducted to indicate where data sources may be considered less reliable or non-existent
2. Consultation with proponents regarding management concerns

The FCP will include air and ground calls to help photo interpreters correlate the vegetation attributes on the ground with those on the imagery (e.g., complex multi-layered stands). The actual air and ground call establishment must reflect the stand types, geographic spread, etc., described in the FCP.

Call numbers for air and ground calls established in the field must match the call numbers in the field calibration plan. Assign new numbers to calls added in the field that were not in the field calibration plan.

The FCP must limit new field calibration calls to no more than one call per polygon. Interpreters may occasionally place new field calibration calls in polygons where the old call no longer represents what is visible in the photo but doubling up old and new calls in the same polygon is not required or desirable.

Approval Process and Plan Content

The Contractor must submit the FCP to the Ministry for approval before the commencement of any field data collection. The Ministry will provide written approval of the FCP to the Contractor after a successful review. The plan must include:

1. An MS Excel spreadsheet (see Table 3 below for an example) showing the distribution of calls by age class, leading species and any calibration points pertaining to items identified in the VRI Project Implementation Plan (VPIP)
2. The number and type (1-point or 3-point clusters) of calibration points proposed. Often more points than required to meet the target may be pre-selected to allow for operational issues such as limited access.
3. Designated staff who will be carrying out the field calibration work, including both air and ground calls
4. Digital map file(s)

Mapping Requirements

A submission format of a shapefiles (.shp) or feature classes in a personal geodatabase (.mdb) for each call type which includes the following map features:

- Proposed Air Call locations with Air Call number
- Proposed extents for air calls
- Proposed Ground Call locations with Ground Call number and number of points
- Any identified multi-layer polygons

Standards:

Calibration Location Agreement

A minimum of 75% of the calibration points identified in the plan must be physically established in the field within 200 m of the planned location. The 25% allowances permit crews to identify stands of interest in the field and establish calls in these areas. Geographic dispersion and stand complexity representation must be maintained. When less than 75% of established calls are within 200 m of the planned location, the Ministry will not pay for additional calls not meeting the 75% criteria. For example, the Ministry will not pay for 5% of the total air or ground calls (as appropriate) if only 70% of the calls fall within 200 m of their planned location without justification and prior Ministry approval.

Air Access Ground Call Plan/Establishment Comparison

The Contractor will clearly identify air-access ground calls in its FCP. The Contractor will also ensure that air access ground calls are established and well-distributed across the project area and the number of established air access ground calls is within the tolerances shown below:

1. The number of *established* air access ground calls must be within ten calls of the number of *planned* air access calls, **and if not**,
2. The difference between the number of planned and established air access ground calls must be within 10% of the number of planned air access ground calls.

Should these criteria not be met, the Ministry will reduce the payment for established air-access ground calls by the number of calls that represent the percentage in excess of 10% between planned calls and the difference between established and planned calls.

An example of the calculations is provided below:

Planned Air-Access ground calls	Established Air-Access Ground calls	Difference	Ratio of difference to planned air access calls
50	37	13	(13 ÷ 50) = 26%

Maximum difference permitted between the established and planned ground calls (%)	10%
Exceedance of Ministry Maximum Allowance (%)	**16%**
Reduction in payment	50 calls × 16% = 8 calls
Total completed ground calls eligible for payment	**42**

Table 3 – Field Calibration Table Summary

Ground Calls	Age Class 1 1-20				Age Class 2 21-40				Age Class 3 41-60				Continue Age Classes	Non Forest		
Existing Species	Total XG	%	Area	%	Total XG	%	Area	%	Total XG	%	Area	%		Total XG	%	Area
SUM																

Air Calls	Age Class 1 1-20				Age Class 2 21-40				Age Class 3 41-60					Non Forest		
Existing Species	Total XV	%	Area	%	Total XV	%	Area	%	Total XV	%	Area	%		Total XV	%	Area
SUM																

Existing Profile By Area							Ground		Air		Total Calls	
Species			Hectares	%	% no NF		# of Calls		# of Calls		# of Calls	%
Estimated Site Index > 0 but no Species 1												
Non Forest												
SUM												
Sum Excluding Non Forest												

List all leading species in the project as per the existing inventory. Species that are a very small portion of the profile may be grouped.

Show the number of calls to be established by each species in each age class.sp

Calls in each species as a percent of the total in THIS Age Class (not of the entire project)

Area in hectares in each species by age class

Area in each species as a percent of the total in THIS age Class (not of the entire project)

This summary is based on the existing forest cover so calls may be desired in areas where new delineation would determine treed label

Expressed as a percent of the TOTAL calls or area for the entire project

Normally we would not establish calls in non forest, so this column excludes the non forest hectares.

This may make a better comparison between the overall air and ground call totals by species.

Appendix E – Enhanced Ground Call Procedures

Objectives

Enhanced Ground Call Procedures have been developed as an option for projects where additional height and diameter information is required. The following procedures can be used on a project-specific basis.

VRI Ground Call procedures will apply, with the following modifications:

- Raw tree data is required for each ground call. Provide the data in a Microsoft XLS or XLSX format. CSV files will also be permitted, provided that NO COMMAS are present INSIDE any data fields (including comments). A file structure is provided in this Appendix C below.
- All 1-point and 3-point ground calls in the project area must be established as *enhanced* ground calls
- For BAF selection, the desired tree count is 6 to 8 live dominant, co-dominant and high intermediate trees per variable radius plot on average. Once a BAF is selected, it will be maintained throughout all of the plots in that polygon.
- All trees must have heights and DBH's recorded (Live and Dead)
- All trees must have an identified live or dead status
- All trees must be identified with a crown class (D, C, H, I, S). H = High intermediates, all other intermediates code as I
- The VRI calibration tile excel sheet will be derived from trees that fall within the D, C and H crown classes.
- The minimum diameter limit will always be 7.5 cm DBH
- Raw field cards or digital field data from Handhelds (as appropriate) will be provided by the Contractor to audit entry into the raw tree data MS Excel template and for field calibration Quality Assurance.
- Collect GPS-captured location data at the mid-point to accurately locate the point for Quality Assurance and validation purposes.
- Heights on trees with a broken top will be measured to the break (not projected to an approximate unbroken top). Record a "B" in the broken top column where appropriate.

The Contractor is responsible for the regular compilation of ground call data for photo interpretation and calibration summary sheets.

In addition to standard audited sample trees, 10% of the heights and diameters in the call will be randomly selected for audit using the height and diameter sample tree standards (as per Appendix A). The scoring will be recorded in the scoring table shown below. The estimated diameter scoring in the standard scoring scheme will no longer apply.

Notwithstanding the above, existing VRI standards apply to all other attributes.

Table 4 – Ground Call Data Template

Call_Number	Point_Number	Mapsheet	BAF	Diameter_Limit	Tree_Number	Species	Live_Dead_(L/D)	Layer	Diameter	Crown_Class	Height	Broken_Top	Age	Inter_Plot_Bearing	Inter_Plot_Distance	UTM_Zone	Easting	Northing	Comments
123	1	092I069	5	7.5	1	PLI	L	2	17.1	I	13.7	N		126	50	10	543210	4567890	
123	1	092I069	5	7.5	2	FDI	L	1	49.0	C	39.2	N	135						
123	1	092I069	5	7.5	3	PLI	L	1	46.4	C	37.1	N	120						
123	1	092I069	5	7.5	4	PLI	L	1	51.4	D	41.1	N							
123	1	092I069	5	7.5	6	PLI	D	D	24.1	-	19.3	Y							
123	2	092I069	5	7.5	1	PLI	L	1	35.3	C	28.2	N	124	126	50				
123	2	092I069	5	7.5	2	PLI	D	D	35.9	-	28.7	N							
123	2	092I069	5	7.5	3	PLI	D	D	28.3	-	22.6	N							
123	2	092I069	5	7.5	4	PLI	L	1	44.3	C	35.4	N							
123	2	092I069	5	7.5	6	PLI	D	D	13.0	-	10.4	N	80	123					
123	3	092I069	5	7.5	1	PLI	L	2	14.6	I	11.7	N		126	50	10	543210	4567890	
Etc.																			

Notes: All enhanced calls will be recorded on the same excel sheet. UTM zone, easting and northing only need to be recorded on one tree line, not repeated for all trees in the plot