
Vegetation Resources Inventory

Data Collection Standards for VRI Ground Sampling

Prepared by
Ministry of Forests and Range
Forest Analysis and Inventory Branch

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Ground Sampling Quality Assurance Standards

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The Resources Inventory Committee consists of representatives from various ministries and agencies of the Canadian and the British Columbia governments as well as from First Nations peoples. RIC objectives are to develop a common set of standards and procedures for the provincial resources inventories, as recommended by the Forest Resources Commission in its report “The Future of our Forests”.

For further information about the Resources Inventory Committee and its various Task Forces, please access the Resources Inventory Committee Website at:
<http://www.for.gov.bc.ca/ric>.

Terrestrial Ecosystems Task Force

The Vegetation Inventory Working Group was formed in 1993 and issued their final report in March 1995 on a “Proposed New Inventory” for British Columbia. The Ministry of Forests, Resources Inventory Branch, in cooperation with the Ministry of Environment and other Ministry of Forests branches and consultants, developed the suite of Vegetation Resources Inventory Procedures based on the recommendations in that report. Many individuals were involved in writing the original version of the various Vegetation Resources Inventory Procedures documents.

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

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Major Amendments

1. The compilation of samples to determine volume and value is now an optional pass/fail standard.
2. A pass/fail point system has been established to give weight to other attributes that are not as important as the critical pass/fail standards, but are still required to be measured accurately.
3. A standard for borderline tree measurements has been added.
4. The critical pass/fail standard for tree length is now an absolute value only.

Table of Contents

| | |
|---|----|
| Ground Sampling Standards | 1 |
| Introduction..... | 1 |
| Timber Attribute Standards..... | 2 |
| Critical Pass/Fail Standards | 3 |
| Plot Cluster Location | 3 |
| Tree Attributes | 3 |
| Pass/Fail Point Standards..... | 4 |
| Plot Cluster Location | 4 |
| Tree Attributes | 4 |
| Site Tree Attributes..... | 4 |
| Small Tree Attributes..... | 4 |
| Optional Critical Pass/Fail Standards | 5 |
| Supporting Information Attributes..... | 5 |
| Plot Cluster Location | 5 |
| Tree Attributes | 6 |
| Stump Attributes | 6 |
| Ecological Attribute Standards | 7 |
| Critical Pass/Fail Standards | 7 |
| Supporting Information Attributes..... | 7 |
| Coarse Woody Debris Attributes..... | 8 |
| Ecological Site Description | 8 |
| Soil Description | 9 |
| Vegetation Layers | 10 |
| Succession Interpretation..... | 11 |

Ground Sampling Standards

Introduction

This document contains the data collection standards for the Ground Sampling phase of the Vegetation Resources Inventory (VRI). The standards were established in consultation with quality assurance auditors, and after a review of audit field data, and are considered achievable by sampling crews.

The standards are based on the assumption that **all batches will be complete when submitted**. This means that all field cards must be completely filled out, photos and maps must meet the requirements as set out in the prework conference, and any other required information must be present as well. If the submitted batches are not complete they will not be accepted and will be returned to the field crew for completion. A batch is an identified number of samples to be completed by the field crew as determined at the pre-work conference.

The document has been separated into a timber section and an ecological section.

Timber Attribute Standards

There are three levels of timber attribute standards specified in this document:

- critical pass/fail standards;
- pass/fail point standards;
- Supporting information standards set for specific attributes and/or details. These attributes are not considered pass/fail criteria; however the established standards are expected to be met.

Critical pass/fail standards have been established for attributes that have an immediate impact on the ability to use the data for its main purpose of adjusting the Phase 1 inventory. If the standards are not met for any of these attributes the sample fails and the batch is rejected.

Pass/fail point standards have been established for many of the attributes that are important but individually do not have as large an impact on the overall result. Points are assigned when the measurement is outside the accepted standard. The sample is rejected when 10 or more points have been accumulated.

Optional critical pass/fail standards have also been established for volume and net value attributes. These attributes require the samples to be compiled before a determination can be made. The decision to use these optional standards will be made by the individual project managers.

Standards have been assigned to all other attributes which are considered as supporting information. It is still expected that the standards for these attributes are to be met. If it is found the attributes are repeatedly measured or conducted below standard the field crew may be required to revisit the batch to ensure project standards are attained.

It is expected that the standards will change over time. Feedback about these standards is appreciated and should be directed to:

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Critical Pass/Fail Standards

Critical pass/fail standards have been established for attributes that have an immediate impact on the ability to use the data for its main purpose of adjusting the Phase 1 inventory. If the standards are not met for any of these attributes the sample fails and the batch is rejected.

Plot Cluster Location

| Attribute | Crew standard |
|---------------------------|---|
| Target polygon | no error permitted |
| Relative cluster location | ± 30 metres when appropriate field ties available |

Tree Attributes

| Attribute | Crew Standard |
|---------------------------|---|
| Tree Count* | no error on clusters with ≤ 15 trees 1 error maximum for clusters with > 15 trees (missed and added trees do not cancel each other) 2 errors allowed for ½ and ¼ fixed radius plots with more than 30 trees |
| Tree Genus | 1 error maximum per cluster |
| Tree Species | 1 error maximum per cluster |
| Live/Dead | 1 error maximum per cluster |
| DBH | Average absolute variation ≤ 2% |
| Tree Length | Average absolute variation ≤ 3% |
| Age/Height Tree Selection | No error allowed in determining the leading species and second species 1 error/cluster allowed in the selection of site trees (includes all leading species, second species, top height and random trees) |
| Net Factor | 90% of the net factors must be within ±10%** (the same log length must be used to determine the net factor) |

* Borderline tree measurements will be assessed as follows: if the borderline 'in' or 'out' tree has been measured and the original in or out status using these measurements has been correctly determined, it will be accepted provided that the original critical distance calculated for the tree does not exceed one percent variation from the check plot critical distance, and the original horizontal distance measured for the tree does not exceed one percent variation from the check plot horizontal distance. For borderline trees only, the critical distance standard written here overrides the dbh standards written in this manual.

All quality assurance of borderline trees will be done using the plot radius factor to the tree face [PRF f]. The plot radius factor to the "tree face" is the plot radius factor to the tree center [PRF c] less 0.005. Using this method, the horizontal distance is measured from the plot center pin to the tree face at DBH.

**Example: net factor between 40% - 60% is acceptable for auditor's result of 50%

Pass/Fail Point Standards

Pass/fail point standards have been established for many of the attributes that are important but individually do not have as large an impact on the overall result. Points are assigned when the measurement is outside the accepted standard. The sample is rejected when 10 or more points have been accumulated.

Plot Cluster Location

| Attribute | Standard | Point Value |
|---|-------------------|-------------|
| Distance - reference pin to IPC (15.0 m) | $\pm 0.2\text{m}$ | 1 |
| Azimuth - reference pin to IPC | $\pm 2^\circ$ | 1 |

Tree Attributes

These attributes must be checked on a minimum of five, randomly selected, IPC or enhanced trees in the cluster. Point values are applied to each tree and are cumulative.

| Attribute | Standard | Point Value |
|---|--------------------------|-------------|
| Stand/fall | Correctly identified | 1 |
| Diameter (if a tree is also a site tree, the site tree standards will be applied instead) | $\pm 3\%$ | 1 |
| Tree length (if a tree is also a site tree, the site tree standards will be applied instead) | $\pm 10\%$ | 2 |
| Crown class | in correct class | 1/2 |
| First log grade | within 1 grade | 1/2 |
| First log length | $\pm 30\%$ of length | 1/2 |
| Second log grade | within 1 grade | 1/2 |
| Second log length | $\pm 30\%$ of length | 1/2 |
| Broken top diameter | $\pm 20\%$ of diameter | 1 |
| Projected height | $\pm 10\%$ of length | 1 |
| Damage agents | 90% correctly identified | 1/2 |
| Loss indicators | 90% correctly identified | 1 |

Site Tree Attributes

These attributes must be measured on all site trees (*top height, leading species, second species and random trees*).

| Attribute | Standard | Point Value |
|----------------------|---------------------|-------------|
| Tree Length | $\pm 3\%$ | 2 |
| Diameter | $\pm 3\%$ | 1 |
| Field Bored age | $\pm 10\%$ | 1/2 |
| Pro-rate Core length | $\pm 1.0\text{ cm}$ | 1/2 |

Small Tree Attributes

| Attribute | Standard | Point Value |
|--------------------|--------------------------|-------------|
| Small tree species | 90% correctly identified | 1/2 |
| Total trees | $\pm 10\%$ | 1/2 |

Optional Critical Pass/Fail Standards

Optional critical pass/fail standards have also been established for volume and net value attributes. These attributes require the samples to be compiled before a determination on pass/fail status can be made. The decision to use these optional standards will be made by the project manager.

| Attribute | Crew Standard |
|---|--|
| Gross volume (m ³ /ha) (4.0cm ⁺ live and dead) | ± 10 m ³ for volumes ≤ 100 m ³ /ha ± 10% for volumes > 100 m ³ /ha |
| Net volume (m ³ /ha) (live trees 4.0cm ⁺) | ± 10 m ³ for volumes ≤ 100 m ³ /ha ± 10% for volumes > 100 m ³ /ha |
| Net value (\$/m ³) (live trees 4.0cm ⁺) | ± 15% |

Supporting Information Attributes

Standards have been assigned to all other attributes which are considered as supporting information. It is still expected that the standards for these attributes are to be met. If it is found the attributes are repeatedly measured or conducted below standard the field crew may be required to revisit the batch to ensure project standards are attained.

Plot Cluster Location

| Attribute | Standard |
|---|------------------|
| Azimuth – tie point tree to tie point | ± 2° |
| Azimuth – reference tree to reference pin | ± 2° |
| Azimuth – tie point to Reference Pin | ± 4° |
| Azimuth – IPC to auxiliary plots | ± 4° |
| Distance from tie point to tie point tree | ± 4% of distance |
| Distance from reference tree to reference pin | ± 4% of distance |
| Distance from tie point to Reference Pin | ± 5% of distance |
| Distance from IPC to auxiliary plots | ± 2.0 m |
| Offset GPS distance to point | ± 4% of distance |
| Random and second transect azimuth | ± 4° |
| Transect length | ± 0.5 m |
| Location of forage plots | ± 0.2 m |
| Herb and bryoid plot (5.64 m) | ± 0.2 m |
| Tree and shrub plot (10.0 m) | ± 0.4 m |
| Azimuth for stem mapping | ± 2° |
| Distance for stem mapping | ± 2% of distance |

Tree Attributes

| Attribute | Standard |
|----------------------------|--|
| Bark remaining % | ± 10% |
| Height to live crown | ± 2 m |
| Visual appearance | 90% in correct or adjacent class |
| Crown condition | 90% in correct or adjacent class |
| Bark retention | 90% in correct or adjacent class |
| Wood condition | 90% in correct or adjacent class |
| Lichen loading | 90% in correct or adjacent class |
| Wildlife use | 90% in correct class |
| Position of loss indicator | ± 1.0 m for indicator in lower 10 m ± 2.0 m for indicator in upper stem |
| Frequency | 90% correctly identified |
| Bark thickness | ± 2 mm or 20% (whichever is greater) |
| 5 year growth | ± 2 mm |
| 10 year growth | ± 4 mm |
| 20 year growth | ± 6 mm |

Stump Attributes

| Attribute | Standard |
|-----------------------------|----------------------------------|
| Stump species | 90% correctly identified |
| Stump diameter inside bark | ± 5 cm |
| Stump length | ± 0.2 m |
| Stump percentage sound wood | ± 20% |
| Stump bark retention code | 90% in correct or adjacent class |
| Stump wood condition code | 90% in correct or adjacent class |

Ecological Attribute Standards

Critical pass/fail standards have been established for attributes that have an immediate impact on the final use of the data. If the standards are not met for any of these attributes the sample fails and the batch is rejected.

Standards have been assigned to all other attributes which are considered as supporting information. It is still expected that the standards for these attributes are to be met. If it is found the attributes are repeatedly measured or conducted below standard the field crew may be required to revisit the batch to ensure project standards are attained.

Critical Pass/Fail Standards

Critical pass/fail standards have been established for attributes that have an immediate impact on the final use of the data. If the standards are not met for any of these attributes the sample fails and the batch is rejected.

| Attribute | Crew Standard |
|---|---|
| Range transect total shrub coverage (m) | ± 15% |
| CWD – Gross volume (m ³ /hectare) | ± 15% |
| Tree/shrub species identification ¹ | > 90% of occurrences correctly identified |
| Herb/bryoid species identification ¹ | > 80% of occurrences correctly identified |

¹Species identification: the species is correctly listed as “counted” and “species correctly recorded” (either as a “known” or else collected and called an “unknown”) by the crew.

Supporting Information Attributes

Standards have been assigned to all other attributes which are considered as supporting information. It is still expected that the standards for these attributes are to be met. If it is found the attributes are repeatedly measured or conducted below standard the field crew may be required to revisit the batch to ensure project standards are attained.

| Attribute | Standard |
|---|--|
| Shrub species | 85% [Maximum ± 2 added or missed] |
| Layer designation - B1 vs. B2 | 95% within correct layer |
| Shrub genus | 90% within correct genus [Maximum 1 missed or added] |
| Phenology | 95% within correct class |
| Transect – percent shrub coverage per species | ± 10% of actual when coverage is < 10.0 m. ± 15% of actual when coverage is ≥ 10.0 m. |
| Graminoid and forb separation | 90% of weight within correct designation |
| Forage utilization | 95% in correct or adjacent class |
| Forage (dry wt.) abundance | ± 2 grams if 0–50g ± 4% if ≥ 50g |

Coarse Woody Debris Attributes

| Attribute | Standard |
|---------------------------|---|
| CWD pieces | ± 2 pieces per transect |
| Species | 90% correct species identified for decay class 1, 2 or 3 pieces 75% correct species identified for decay class 4 or 5 pieces |
| Diameter | ± 4 cm for stems < 40 cm ± 10% for stems ≥ 40 cm |
| Length (optional in VRI) | ± 0.4 m for pieces < 10 m ± 5% for pieces > 10 m |
| Percent decay class 1 | ± 10% when sound portion > 80% ± 20% when sound portion < 80% |
| Other decay class | 90/100 in correct class |
| Tilt angle | ± 5° |
| Merchantability | 80% correctly identified as “X” grade or better [Maximum 1 error] |
| Product to remove | 98% in correct class [Maximum 1 error] |
| Decay class for the piece | 90% in correct or adjacent class |

Ecological Site Description

| Attribute | Standard |
|--|--|
| Uniformity code | ± 1 class |
| Zone | No error unless on a transition boundary |
| Subzone | No error unless on a transition boundary |
| Variant | No error unless on a transition boundary |
| Slope | ± 5% |
| Aspect | ± 20° |
| Elevation | ± 50 metres |
| Surface shape | 100% within correct or adjacent class |
| Meso-slope position | 100% within correct or adjacent class |
| Microtopography | 100% within correct or adjacent class |
| % coverage of cobbles & stones | ± 5% if < 20% coverage; ± 10% if ≥ 20% coverage |
| % coverage of bedrock | ± 5% if < 20% coverage; ± 10% if ≥ 20% coverage |
| Flood hazard | 100% in correct or adjacent category |
| % coverage of flowing water | ± 5% if < 20% coverage; ± 10% if ≥ 20% coverage |
| % coverage of standing water | ± 5% if < 20% coverage; ± 10% if ≥ 20% coverage |
| Slope failure in plot | No error |
| Slope failure between plots | No error |
| Gullies within plot | No error |
| Gullies between plots | No error |
| Soil moisture regime | ± one category |
| Soil nutrient regime | ± one category |
| Site series number | no error unless on boundary transition (use SMR/SNR) |
| Land cover - level 1 (vegetated versus non vegetated) | no error unless on boundary of class |
| Land cover - level 2 | no error unless on boundary of class |

| Attribute | Standard |
|---|--------------------------------------|
| (treed versus non-treed) | |
| Land cover - level 3 (wetland / upland / alpine) | no error unless on boundary of class |
| Land cover - level 4 (cover type) | ± one category |
| Land cover - level 5 (density description) | ± one category |

Soil Description

| Attribute | Standard |
|------------------------------------|---|
| Soil horizons | main rhizosphere identified correctly, for other layers ± one layer |
| Distance from zero for each layer | ± 10 cm |
| Texture for each identified layer | 100 % in correct or adjacent class |
| Total % coarse fragments | ± 10% for fragments < 35 % ± 20 % for fragments ≥ 35 % |
| % gravel | ± 10% for fragments < 35 % ± 20 % for fragments ≥ 35 % |
| % cobbles and stones | ± 10% for fragments < 35 % ± 20 % for fragments ≥ 35 % |
| Depth to water table | ± 10 cm |
| Depth to gleying | ± 5 cm |
| Depth to root restricting pan | ± 5 cm |
| Depth to bedrock | ± 10 cm |
| Depth to frozen layers | ± 10 cm |
| Depth to carbonates | ± 10 cm |
| Humus form | no error within main category (mull, moder, mor) |
| Surficial material (primary layer) | no error |
| Soil colour | ± one category |
| L/F/H description and depth | layers correctly identified and within 2 cm. Cumulative depth |

Vegetation Layers

| Attribute | Standard |
|---|--|
| Tree Species identified | 90% correctly identified |
| Overall cover estimate "A" layer | ± 10 % for cover > 25 % ± 5 % for cover 11 to 25 % ± 3 % for cover 6 to 10 % ± 0.5 % for cover 0.5 % to 5 % |
| Overall cover estimate "B1" layer | ± 10 % for cover > 25 % ± 5 % for cover 11 to 25 % ± 3 % for cover 6 to 10 % ± 0.5 % for cover 0.5 % to 5 % |
| Shrub species identified | 90% correctly identified |
| Overall cover estimate "B2" layer | ± 10 % for cover > 25 % ± 5 % for cover 11 to 25 % ± 3 % for cover 6 to 10 % ± 0.5 % for cover 0.5 % to 5 % |
| Species coverage Layer "A" | ± 10 % for cover > 25 % ± 5 % for cover 11 to 25 % ± 3 % for cover 6 to 10 % ± 0.5 % for cover 0.5 % to 5 % |
| Attribute | Crew Standard |
| Species coverage – layer "B1" | ± 10 % for cover > 25 % ± 5 % for cover 11 to 25 % ± 3 % for cover 6 to 10 % ± 0.5 % for cover 0.5 % to 5 % ± 10% if "A" layer > 10% ± 5% |
| Species coverage – layer "B2" | ± 10 % for cover > 25 % ± 5 % for cover 11 to 25 % ± 3 % for cover 6 to 10 % ± 0.5 % for cover 0.5 % to 5 % |
| Average height of B 1 layer | ± 1 metre |
| Average height of B 2 layer | ± 0.4 metres |
| Percent coverage by species of seedlings (Dh, Dw, and Dr) | ± 10 % for cover > 25 % ± 5 % for cover 11 to 25 % ± 3 % for cover 6 to 10 % ± 0.5 % for cover 0.5 % to 5 % |
| Herb species identified | 90% correctly identified |
| Bryoid species identified | 80% correctly identified |
| Overall coverage of layer C | ± 10 % for coverage > 30 % ± 5 % for coverage 16 to 30 % ± 2 % for coverage 6 to 15 % ± 1 % for coverage 1 to 5 % |
| Overall coverage of layer D | ± 10 % for coverage > 30 % ± 5 % for coverage 16 to 30 % ± 2 % for coverage 6 to 15 % ± 1 % for coverage 1 to 5 % |
| Species ID ¹ -layer "C,Dh,Dw,Dr" | 80/100 correct species |
| Species coverage – layer "C" | ± 10 % for coverage > 30 % |

Ground Sampling Quality Assurance Standards

| Attribute | Standard |
|-------------------------------|--|
| | ± 5 % for coverage 16 to 30 % ± 2 % for coverage 6 to 15 % ± 1 % for coverage 1 to 5 % |
| Species coverage – layer “Dh” | ± 10 % for coverage > 30 % ± 5 % for coverage 16 to 30 % ± 2 % for coverage 6 to 15 % ± 1 % for coverage 1 to 5 % |
| Species coverage – layer “Dw” | ± 10 % for coverage > 30 % ± 5 % for coverage 16 to 30 % ± 2 % for coverage 6 to 15 % ± 1 % for coverage 1 to 5 % |
| Species coverage – layer “Dr” | ± 10 % for coverage > 30 % ± 5 % for coverage 16 to 30 % ± 2 % for coverage 6 to 15 % ± 1 % for coverage 1 to 5 % |

Species identification is for species listed as “known” by crew.

Succession Interpretation

| Attribute | Standard |
|--|---|
| Factors influencing vegetation establishment | ± one factor missed or added |
| Previous species | must have at least one species of two correctly identified |
| Current species | must have at least one species of two correctly identified |
| Tree harvesting | In correct or adjacent category |
| Presence of snags | In correct or adjacent category |
| Snags and CWD presence | In correct or adjacent category |
| Canopy gaps | In correct or adjacent category |
| Vertical structure | In correct or adjacent category |
| Successional stability | In correct or adjacent category |
| Tree size | In correct or adjacent category |
| Tree age | In correct or adjacent category |
| Structural stages | In correct or adjacent category |
| % old trees alive | ± 10% |
| Old growth | “No” correctly identified “No (some) or Yes in correct or adjacent class |