
Vegetation Resources Inventory

Ground Sampling Quality Assurance Standards

Prepared by
Ministry of Forests
Resources Inventory Branch
for the Terrestrial Ecosystem Task Force
Resources Inventory Committee

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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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Ground Sampling Standards

Introduction

This document contains the standards for the Ground Sampling phase of the Ministry of Forests, Vegetation Resources Inventory (VRI), that are to be used in the 2001 field season. The standards were established in consultation with quality assurance auditors, and after a partial review of 1999 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.

There are two sets of standards specified in this document: pass/fail standards set for the entire sample and individual standards set for specific attributes and/or details. Most individual attributes are not considered pass/fail criteria, however the established standards are expected to be met.

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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<http://www.for.gov.bc.ca/resinv/Veginv/ChangeMgmt00/change.htm>

Pass / Fail Criteria

Within the VRI Ground Sampling there are important attributes for which pass/fail standards have been established. Not meeting these standards for a cluster will result in the failure of the sample batch from which the sample was selected. The batch as a whole will then need to be revisited to correct the attributes in question and will be subject to additional audit.

The following are the current pass / fail attributes:

- **Plot Cluster Location**
 - plot cluster within target polygon as determined on the ground
 - plot cluster in “relative” correct location and correct number of auxiliary plots established
 - auditor must be able to relocate plot following access and navigation notes

- **Tree Attributes**
 - gross volume per hectare
 - net volume per hectare
 - net value per hectare
 - tree count per cluster
 - tree genus
 - tree species
 - live/dead classification
 - diameter at breast height
 - tree length
 - selection of age/height trees

- **Ecological Attributes**
 - range transect total shrub coverage
 - coarse woody debris gross volume per hectare
 - tree - shrub species identification
 - herb - bryoid species identification

The pass/fail criteria listed above apply to all projects conducted using VRI procedures. Note that specific projects may have additional requirements specified in the contract documents. For instance, “non-fail” attributes that are repeatedly measured or conducted below standard may require a revisit to the batch to ensure project standards are attained.

Pass/Fail Standards

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 |
|---|--|
| 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% |
| 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%; none over 5% |
| Age/Height Tree Selection | No error allowed in determining the leading species and second species 1 error/cluster allowed in the selection of leading species trees |

Ecological Attributes

| 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.

Plot Cluster Location Standards

| Attribute | Crew Standard |
|---|-----------------------|
| Azimuth – tie point tree to tie point | $\pm 2^\circ$ |
| Azimuth – reference tree to reference pin | $\pm 2^\circ$ |
| Azimuth – tie point to Reference Pin | $\pm 4^\circ$ |
| Azimuth – IPC to auxiliary plots | $\pm 4^\circ$ |
| Distance from tie point to tie point tree | $\pm 4\%$ of distance |
| Distance from reference tree to reference pin | $\pm 4\%$ of distance |
| Distance from tie point to Reference Pin | $\pm 5\%$ of distance |
| Distance from IPC to auxiliary plots | ± 2.0 m |
| Distance from reference pin to IPC (15.0 m) | ± 0.2 m |
| Offset GPS bearing to point | $\pm 2^\circ$ |
| Offset GPS distance to point | $\pm 4\%$ of distance |
| Random and second transect azimuth | $\pm 4^\circ$ |
| 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 | $\pm 2^\circ$ |
| Distance for stem mapping | $\pm 2\%$ of distance |

Tree Attribute Standards

Tree Details Attributes

| Attribute | Crew Standard |
|------------------------|---|
| Tree count | No Error when tree count less than or equal to 15 trees in cluster Maximum 1 added or missed tree when tree count in cluster > 15 2 errors allowed for ½ and ¼ fixed radius plots with more than 30 trees |
| Genus | 1 error maximum per cluster |
| Species | 1 error maximum per cluster |
| Live/dead | 1 error maximum per cluster |
| Stand/fall | 1 error maximum per cluster |
| Diameter breast height | Average absolute variation ≤ 2% |
| Bark remaining % | ± 10% |
| Tree length | Average absolute variation ≤ 3%; none over 5% |
| Crown class | 90/100 in correct class |
| Height to live crown | ± 2 m on crowns < 10 m ± 20% on crowns > 10 m |
| First log grade | 90/100 within 1 grade |
| First log length | ± 30% of length |
| First log net factor | ± 5% when net factor > 80% ± 20% when net factor < 80% |
| Second log grade | 90/100 within 1 grade |
| Second log length | ± 30% of length |
| Second log net factor | ± 5% when net factor > 80% ± 20% when net factor < 80% |
| Third + log grade | * 90/100 in correct "category" |
| Third log length | ± 30% of length |
| Third log net factor | ± 5% when net factor > 80% ± 20% when net factor < 80% |
| Visual appearance | 90/100 in correct or adjacent class |
| Crown condition | 90/100 in correct or adjacent class |
| Bark retention | 90/100 in correct or adjacent class |
| Wood condition | 90/100 in correct or adjacent class |
| Lichen loading | 90/100 in correct or adjacent class |
| Wildlife use | 90/100 in correct class |
| Broken top diameter | ± 20% of diameter |
| Projected height | ± 10% of length |

Tree Loss Indicators Attributes

| Attribute | Crew Standard |
|---|--|
| Damage agents | 90/100 correctly identified |
| Loss indicators | 90/100 correctly identified |
| Position of loss indicator or upper and lower extent of loss indicator(s) | ± 0.5 m for indicator in lower 10 m ± 1.0 m for indicator in upper stem |
| Frequency | 90/100 correctly identified |

Age/Height Tree Attributes

| Attribute | Crew Standard |
|-------------------------|--|
| Top height tree | no error allowed in selection |
| Leading species tree(s) | no error allowed in determining leading species 1 error/cluster allowed in the selection of leading species trees |
| Second species tree | no error allowed in selection of species or tree |
| Random tree | no error allowed in selection |
| Bark thickness | ± 2 mm when bark < 10 mm ± 20% bark > 10 mm |
| Field Bored age | ± 2 rings if < 20 years ± 5% if ≥20 years and < 100 years ± 10% if ≥ 100 and years and < 200 years ± 20% if > 200 years |
| 5 year growth | ± 2 mm |
| 10 year growth | ± 4 mm |
| 20 year growth | ± 6 mm |
| Pro-rate Core length | ± 1.0 cm |

Small Tree Attributes

| Attribute | Crew Standard |
|---|-----------------------------|
| Small tree species | 90/100 correctly identified |
| Trees 10 to 30 cm in height | ± 20% of tree count |
| Trees 31 to 130 cm in height | ± 10% of tree count |
| Trees 130 cm in height to 3.9 cm in diameter at breast height | ± 10% of tree count |

Stump Attributes

| Attribute | Crew Standard |
|-----------------------|---|
| Stump species | 90/100 correctly identified |
| Diameter inside bark | ± 2 cm for stems < 25 cm ± 5 cm for stems > 25 cm |
| Length | ± 0.2 m |
| Percentage sound wood | $\pm 5\%$ when sound portion $> 80\%$ $\pm 20\%$ when sound portion $< 80\%$ |
| Bark retention code | 90/100 in correct or adjacent class |
| Wood condition code | 90/100 in correct or adjacent class |

Ecological Attribute Standards

Range Attributes

| Attribute | Crew Standard |
|---|---|
| Shrub species | 85/100 [Maximum ± 2 added or missed] |
| Layer designation B1 vs. B2 | 95/100 within correct layer |
| Shrub genus | 90/100 within correct genus [Maximum 1 missed or added] |
| Phenology | 95/100 within correct class |
| Transect – percent shrub coverage per species | $\pm 10\%$ of actual when coverage is < 10.0 m. $\pm 15\%$ of actual when coverage is ≥ 10.0 m. |
| Graminoid and forb separation | 90/100 of weight within correct designation |
| Forage utilization | 95% in correct or adjacent class |
| Forage (dry wt.) abundance | ± 2 grams if 0–50g $\pm 4\%$ if ≥ 50 g |

Coarse Woody Debris Attributes

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

Ecological Site Description

| Attribute | Crew Standard |
|-----------|---------------|
|-----------|---------------|

Vegetation Resources Inventory

| Attribute | Crew 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 and 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 ± 4% |
| % coverage of standing water | ± 5% if < 20% coverage ± 10% if ≥ 20% coverage ± 4% |
| 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 (treed versus non-treed) | no error unless on boundary of class |
| 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 | Crew Standard |
|------------------------------------|---|
| Soil horizons | main rhizosphere identified correctly, for other layers \pm one layer |
| Distance from zero for each layer | \pm 10 cm |
| Texture for each identified layer | 100 % in correct or adjacent class |
| Total % coarse fragments | \pm 10% for fragments < 35 % \pm 20 % for fragments \geq 35 % |
| % gravel | \pm 10% for fragments < 35 % \pm 20 % for fragments \geq 35 % |
| % cobbles and stones | \pm 10% for fragments < 35 % \pm 20 % for fragments \geq 35 % |
| Depth to water table | \pm 10 cm |
| Depth to gleying | \pm 5 cm |
| Depth to root restricting pan | \pm 5 cm |
| Depth to bedrock | \pm 10 cm |
| Depth to frozen layers | \pm 10 cm |
| Depth to carbonates | \pm 10 cm |
| Humus form | no error within main category (mull, moder, mor) |
| Surficial material (primary layer) | no error |
| Soil colour | \pm one category |
| L/F/H description and depth | layers correctly identified and within 2 cm. Cumulative depth |

Vegetation Layers

| Attribute | Crew Standard |
|-----------------------------------|--|
| Tree Species identified | 90/100 correctly identified |
| Overall cover estimate "A" layer | \pm 10 % for cover > 25 % \pm 5 % for cover 11 to 25 % \pm 3 % for cover 6 to 10 % \pm 0.5 % for cover 0.5 % to 5 % |
| Overall cover estimate "B1" layer | \pm 10 % for cover > 25 % \pm 5 % for cover 11 to 25 % \pm 3 % for cover 6 to 10 % \pm 0.5 % for cover 0.5 % to 5 % |
| Shrub species identified | 90/100 correctly identified |
| Overall cover estimate "B2" | \pm 10 % for cover > 25 % |

Vegetation Resources Inventory

| Attribute | Crew Standard |
|---|--|
| layer | ± 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 % |
| 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 | 90/100 correctly identified |
| Bryoid species identified | 80/100 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 % ± 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 % |

Ground Sampling Quality Assurance Standards

| Attribute | Crew Standard |
|-------------------------------|--|
| | ± 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 | Crew 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 |