Change Monitoring Inventory

Ground Sampling Quality Assurance Standards

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Ministry of Forests and Range
Forest Analysis and Inventory Branch

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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://ilmbwww.gov.bc.ca/risc/about.htm .

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. Formatting changes for consistency with Vegetation Resources Inventory Ground Sampling QA Standards.

4. Tree length standards modified.

Table of Contents

Ground Sampling Standards

Introduction

This document contains the standards for the Ground Sampling phase of the Ministry of Forests, Change Monitoring Inventory (CMI). 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.

Ground Sampling 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 a number of attributes. 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
Relative IPC location	± 30 metres when appropriate field ties available

Tree Attributes

Attribute	Crew Standard
Tree Count	no error on quadrants with <= 25 trees 1 error maximum for quadrants with > 25 trees (missed and added trees do not cancel each other)
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% individual site tree lengths must be within 5%. Site trees under 10m must be within 50cm of auditor length
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)

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

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

[1]Species 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.

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%

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)	± 0.2m	1
Azimuth - reference pin to IPC	± 2°	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)	± 3%	1
Tree length (if a tree is also a site tree, the site tree standards will be applied instead)	± 10%	2
Crown class	in correct class	½
First log grade	within 1 grade	½
First log length	± 30% of length	½
First log net factor	± 5% when net factor > 80% ± 20% when net factor < 80%	½
Second log grade	within 1 grade	½
Second log length	± 30% of length	½
Second log net factor	± 5% when net factor > 80% ± 20% when net factor < 80%	½
Broken top diameter	± 20%of diameter	1
Projected height	± 10% of length	1
Damage agents	90% correctly identified	½
Loss indicators	90% correctly identified	1

Site Tree Attributes

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

Attribute	Standard	Point Value
Top Height Tree Selection	NoError	1
Diameter	± 3%	1
Field Bored age	± 10%	½
Pro-rate Core length	± 1.0 cm	½

Small Tree Attributes

Attribute	Standard	Point Value

Small tree species	90% correctly identified	½
Total trees	± 10%	½

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.

Navigation and Layout

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 reference pin to IPC (15.0 m)	± 0.2m
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
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% 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 Attributes

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 %

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