LAND MANAGEMENT HANDBOOK

25

Field Manual for Describing Terrestrial Ecosystems 2nd Edition

2010

BRITISH COLUMBIA
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B.C. Ministry of Forests and Range
B.C. Ministry of Environment

Field Manual for Describing Terrestrial Ecosystems 2nd Edition

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Preface

How to use this manual

This manual has been prepared to assist field surveyors in the completion of the Ecosystem Field Forms, including site, soil, vegetation, mensuration, wildlife habitat assessment, tree attributes for wildlife, and coarse woody debris data forms. These are a series of forms for the collection of ecological data in British Columbia.

The field manual is organized by section—one for each data form. The forms, as a package, are called Ecosystem Field Forms (FS882) and are numbered as follows:

Site Description FS882(1) . . . . . **SITE**
Soil Description FS882(2) . . . . . **SOIL**
Vegetation FS882(3) . . . . . **VEG**
Mensuration FS882(4) . . . . . **MENS**
Wildlife Habitat Assessment FS882(5) . . . . . **WHA**
Tree Attributes for Wildlife (FS882(6) . . . . . **TAW**
Coarse Woody Debris FS882(7) . . . . . **CWD**
Site Visit FS1333 . . . . . **SIVI**

The forms are designed to be used in various inventories; for example, ecosystem classification, terrestrial ecosystem mapping, and wildlife habitat assessment. Not all the data fields on all the forms will be completed on every sample plot. Rather, project objectives will determine which forms and fields need to be completed. Likewise, project objectives will determine where and how plots are located.

The field manual follows *Describing Ecosystems in the Field* (Luttmerding et al. 1990) and the *Field Manual for Describing Terrestrial Ecosystems* (Province of British Columbia 1998); however, it has been updated to accommodate new field forms and updates to code standards and inventory requirements. The forms evolved from the B.C. Ministry of Forests and Range Ecological Classification Reconnaissance Form, the larger, more detailed forms in Luttmerding et al. (1990), and the Vegetation Resource Inventory forms (Resources Inventory Committee 1997).

As this is a field manual, the descriptions have been kept as brief as possible. Other supporting references, such as Luttmerding et al. (1990), Green et al. (1993), Howes and Kenk (1997), and Agriculture Canada Expert Committee on Soil Survey (1998), among others, will be required if the user is not already familiar with their contents. See References for a complete list of complementary documents.

Changes in the 2nd edition of LMH25

The overall content and layout of the 2nd edition of LMH25 remain very similar to the 1st edition. However, the following notable changes have been incorporated.

- All FS882 forms updated to the 2008 standard.

Site Description (SITE) Section

- Location accuracy field added and georeferencing text changed. Stand age field added. Forest Region codes updated to new FS Region and District Codes.
- Codes and text describing additional non-forested ecosystems added. Site Realm/Classes added.
- Successional stage text reworked. "Old climax stand" successional stage added.
- Structural stage text reworked. "Old Forest" and "Very Old Forest" sub-stages added.
- Structural stage modifiers renamed. Canopy structure modifiers added. Irregular and Shelterwood modifiers removed. Anthropogenic modifier added.
- "Gully" slope position added.

Soil Description (SOIL) Section

- Humus form phase field and corresponding codes and text added.
- Codes for soil Great Groups added.

Vegetation (VEG) Section

- Column to mark collected specimens added.
- Additional coding for arboreal lichens and non-timber quality codes added.

Mensuration (MENS) Section

- Relevant cruise information and tree attributes for wildlife added.

Wildlife Habitat Assessment (WHA) Section

- No changes.

Tree Attributes for Wildlife (TAW) Section

- No changes.

Coarse Woody Debris (CWD) Section

- No changes.

Site Visit Standards (SIVI) Section

- GIF section replaced by new form (FS1333) and text.
- Additional field required for evaluation of site series or site quality added to form.
- Levels of plot data collection and required fields added.

- For collection of point information, polygon assessment fields and text removed.
- Appendix outlining data field standards presented.

Keys and Codes (KEYS) Section

- Compilation of keys to identification and code tables from several sources added.

Acknowledgements

This field manual was compiled and edited from material from many sources. As such, there are no easily identifiable authors. Most of the compilation and editing for the 2010 edition was completed by Will MacKenzie. The bulk of material is based on the 1998 edition compiled by Del Meidinger, Rick Trowbridge, Anne Macadam, and Calvin Tolkamp. However, many others kindly contributed their time and current information to this version, including Del Meidinger, Deb MacKillop, Sari Saunders, Ben Heemskerk, Bruce Rogers, and Cory Erwin. Deepa Filatow reviewed and made suggestions for parts of the soil section. Anne Macadam produced the keys to soil orders and soil groups and subgroups.

Assistance in editing and reviewing various versions was provided by John Parminter, Bob Maxwell, Scott Smith, Charles Tarnocai, Ted Lea, Barb von Sacken, Carmen Cadrin, Larry Lacelle, Tina Lee, and Arman Mirza.

Contributors to other documents and forms also assisted with this field manual by their work on classifications, procedures, diagrams, figures, tables, or design. All the manuals, reports, and publications used to prepare this field manual are listed in the References section. The authors, compilers, and contributors to these primary sources of information are gratefully acknowledged. Their unselfish work has made this field guide possible.

Many others contributed to the production of this field manual. Paul Nystedt guided the publication. Graphics and layout were completed by Donna Lindenberg of Newport Bay Publishing Limited.

The compilers of this field manual greatly appreciate everyone's contributions.

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1 SITE DESCRIPTION

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ECOSYSTEM FIELD FORM

BRITISH COLUMBIA

MINISTRY OF FORESTS
AND RANGE
MINISTRY OF ENVIRONMENT

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BEDROCK		WATER	

FS882 (1) HRE 2008/03

Field Procedure

Pre-work

Procedures and standards should be set before field work begins, and coordinated between field crews for the following attributes:

- Project ID label
- Field number format
- GPS georeferencing standards: coordinate system, lat/long format, datum, and precision standard
- Sections or Fields of the FS882 which are mandatory, optional, or not required for the objectives of the project
- Plot photo standards
- Plant collections procedure

Getting Started in the Field

1. Record the date, project ID, field number, surveyor(s) name(s), general location, forest region and district, and ecosection. Copy the plot number to other forms.
2. If air photos are available, record flight line and photo numbers at this time.
3. Establish plot centre and georeference with a GPS, record latitude and longitude and estimated location accuracy in metres. Use location averaging if available.
3. Establish the location of plot boundaries.

In most cases, a plot size of 400 m^2 is considered adequate, however, in species-poor ecosystems, the plot size could be smaller (e.g., some wetlands, grasslands, dense forests). Plot shape can be rectangular, square, or circular, but is usually consistent for a project.

Measure and Assess

1. Determine the elevation, slope, and aspect.
2. Traverse the entire plot systematically, observing the position of the plot relative to the surrounding landscape, microtopographic features, and the composition of surface substrates. Record meso-slope position, surface topography and percentage of substrate classes.
3. Note any evidence of site disturbance.
4. Assess successional status and structural stage based on site factors and vegetation.
5. Integrate site, soil, and vegetation factors to determine moisture and nutrient regime and biogeoclimatic unit.
6. Based on the foregoing assessments, determine site series. If the site is complex, estimate and record the proportion of the plot represented by each site series and determine the transition/distribution code.

7. If applicable, enter exposure type and realm/class.
8. Sketch a plot diagram.
9. Photograph a portion of the plot which the crew considers representative of the site. It is perferable to include people or scale devises in the photo and to use a wide angle lens.
10. Enter a brief description of key site features under Item 15, "Plot Representing."
11. Check that all the required form information has been collected. Strike through any fields that were not assessed.

Later in the Office

1. Check again that all the required information has been collected and noted on each form.
2. Enter plot information into a data standard structure. Several programs are available at www.for.gov.bc.ca/hre/becweb/resources/software/index.html
3. Organize and relabel digital plot photos to include the plot number.
4. Photocopy plot cards and provide copy or original to the regional ecologist along with digital photos.

Refer to the following guides for more information:

- Ministry of Forests and Range (MFR) regional field guides to site identification and interprepation
- *Describing Ecosystems in the Field* (DEIF) manual (Luttmerding et al. 1990)

Completing the Form

Numbered items below refer to circled numbers on the ecosystem field form shown at the beginning of this section. A recommended sequence for completing the form is described under "Field Procedure."

1. Date

Enter two-digits each for year, month, and day.

2. Plot Number

A unique number is printed on each FS882 card. This is the unique plot identifier for data management purposes. Record this number on all other forms completed for the plot.

3. Project ID

Enter a project name that connotes the type of project and provides information about the subject, location, and/or year of the project as appropriate. For example:

- ecosystem mapping projects: BeaverCove_TEM
- species inventory: Woss_SppInv
- site series classification: SBSwk1_BEC
- wildlife habitat inventory: KhutzeGrizzly_WHA
- site index: Morice2009_SIBEC

4. Field Number

Use up to seven characters to further identify the plot according to the needs of the specific project. It is useful to use a unique number series for the field number in the form of year + initials + 3-digit running number (e.g. 09WM001) for instances where this number is used as a unique identifier in data management

5. Surveyor(s)

Record the full initials each person involved in describing the site.

6. General Location

Describe the location of the plot at a regional and local scale relative to natural features such as mountains or bodies of water and permanent structures such as kilometre signs on main roads. This description should allow other users to locate the general position of the plot on a map and, where required by contract, assist field workers in relocating the plot in the field .

- Select points of reference that are unlikely to change and are named on maps or are otherwise easily identified.
- Include compass bearings and distances (measured or estimated), where possible.
- More detailed access information may be recorded under Item 37, "Notes."

7. Forest Region/District

This information can be useful for sorting plot data. Use the following codes:
RCO = Coast Forest Region
RNI = Northern Interior Forest Region
RSI = Southern Interior Forest Region.
District codes may also be recorded in the form RCO.DHG (Haida Gwaii District). Forest District codes are listed in Appendix 1.1

8. Map Sheet

Use the B.C. Geographic System to identify the map sheet on which the plot is located (e.g., 93H015). The preferred map scale is 1:20,000.

9. UTM Zone
If using the UTM system to indicate precise plot location, enter the UTM zone number indicated on the map sheet (8–11 within British Columbia). The present standard for UTM data is NAD83. Most new maps follow this standard. Older maps, and some new maps use NAD27 which will cause significant location errors if it is mistaken for NAD83.

10. Latitude/Longitude or Northing/Easting
Determine the precise location of the plot (Lat./North. & Long./East). Georeferencing should be determined using GPS. Although either co-ordinate system may be used, Latitude/Longitude system is preferred.

- For latitude and longitude, note degrees (°), minutes ('), and decimal seconds (").
- For UTM system, record zone and easting and northing

11. Accuracy (m)
Record the estimated georeferencing accuracy in metres.

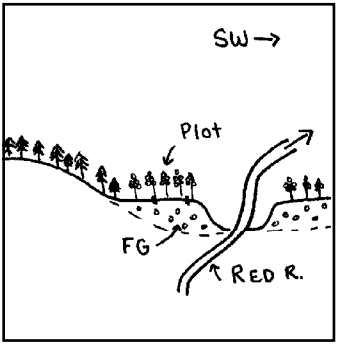
12. Air Photo Number
Record the flight line and air photo number, if applicable.

13. X/Y Co-ordinates
Using a plastic air photo grid overlay (2M–79), record values of *X* and *Y* co-ordinates for the intersecting lines closest to the plot location. Place the grid over the photograph *with photo number viewed upright* and the origin of grid axes aligned with the lower left-hand corner. Be sure to align centre and feducial points (points at corners or centre of each side of photograph).

14. Ecosection
Enter a three-letter code for the ecosection. See http://www.for.gov.bc.ca/hre/becweb/resources/codes-standards/standards-becdb.html for a current listing of codes.

15. Site Diagram
A cross-sectional diagram of plot location in relation to the surrounding landscape is often most useful. Use the diagram to provide additional information about site features or to assist in locating the plot again. Stand structure, mesoslope position, physical features of the surrounding landscape, and plot location relative to identifiable landmarks such as bodies of water or roads can be depicted (Figure 1.1).

16. Photo
Record the image number(s) and camera used for all plot photos. Digital phots should be renamed to the Plot number in the office.



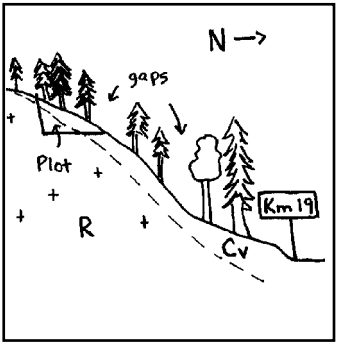


FIGURE 1.1 Examples of site diagrams.

17. Plot Representing

Provide a statement that outlines the important characteristics of the sampled ecosystem. Plot Representing should provide a concise description describing the key attributes of the site.

For example:

- 30-year-old planted Pl stand; kinnikinnick, lichens on FG terrace
- Productive zonal Fd - Pinegrass stand on warm aspect
- Mature Sxw– horsetail–ladyfern, Hydromor, Humic Gleysol, on floodplain.

18. Biogeoclimatic Unit

Enter the code for the biogeoclimatic zone and subzone. Include variant and phase where applicable. Ministry of Forests and Range (MFR) maps and regional field guides to site identification and interpretation are the best sources of information. The most up-to-date listing of codes is posted at www.for.gov.bc.ca/hre/becweb/resources/codes-standards/standards-becdb.html.

- In areas *distinctly* transitional between two recognized biogeoclimatic units, enter the code for the dominant unit here and mark with an asterisk (*). Identify other unit and explain under "Notes" (Item 37).

19. Site Series

Enter a two- or three-digit site series code and a coding for site series phases or seral designation, where recognized, from the appropriate MFR regional field guide to site identification and interpretation. Note the following special cases:

- If two or more distinct site series are present, list in order of predominance, followed by the proportion of the plot represented by each in percent in the "Plot Representing" field. For example: 01a (70%), 05 (30%).

- Where site characteristics are uniform, but distinctly transitional between two recognized site series, indicate with a dash (e.g., 01a–05). Comment in under "Notes."
- If the ecosystem does not resemble a recognized site series, leave this field blank, and explain under "Notes."

20. Realm/Class

For non-forested ecosystems, enter the following codes , where applicable. Further description of these units is found on the BECWeb site.

Code	Name	Description
Af	**Alpine Fellfield**	Ecosystems of winter wind-exposed sites where the dynamics of soil freeze and thaw cycles and of wind give rise to characteristic sparse, low plant cover in a rocky or scree matrix.
Ag	**Alpine Grassland**	Well-vegetated and grass dominated ecosystems of dry, cold climates with low but significant snow load and well-developed soils.
Ah	**Alpine Heath**	Mountain-heather dominated snowbed ecosystems that are widespread and common throughout B.C. in snow accumulating sites and stable substrates.
Am	**Alpine Meadow**	Well-vegetated and forb dominated ecosystems of subalpine and alpine elevations.
As	**Alpine Nivation**	Sparsely vegetated and low diversity ecosystems occurring under very deep or persistent snow packs that last well into the growing season, typically on north aspects and/or lee slopes.
At	**Alpine Tundra**	Well-vegetated ecosystems of mixed composition commonly with an abundance of dwarf woody plants.
Az	**Alpine Zoogenic**	Highly localized alpine ecosystems where concentrated animal activities (turbation, defecation, etc) affect vegetation.
Bb	**Beach Beachland**	Halophyte or graminoid ecosystems that occur on unconsolidated beach sediments (sands/gravels) in the supratidal zone of the marine environment.
Br	**Beach Headland**	Floristically variable ecosystems of rocky or stable substrate (islets or headlands) that are affected by saltwater spray and splashing.
Ed	**Estuary Meadow**	Ecosystems of the high intertidal zone of estuaries, where tidal flooding occurs less frequently than daily and is tempered by freshwater mixing. Species composition is relatively diverse, typically with a mix of graminoids and forbs.

Code	Name	Description
Em	**Estuary Marsh**	Ecosystems of the intertidal that are flooded diurnally and have simple communities dominated by salt-tolerant emergent graminoids and succulents.
Et	**Estuary Tidal Flat**	Intertidal ecosystems of mudflats dominated by benthic/burrowing fauna and macroalgae.
Fa	**Flood Active Channel**	Ecosystems scoured by river floodwaters for prolonged periods and are usually dominated by annuals, or herbs that can resprout from underground structures.
Ff	**Flood Fringe**	Tall shrub ecosystems that develop on non-alluvial soils next to waterbodies that provide subirrigation and modified climate but where there is no surface flooding. Most common in dry climates.
Fl	**Flood Lowbench**	Tall shrub ecosystems of floodplain sites that are flooded for moderate periods (< 40 days) of the growing season.
Fm	**Flood Midbench**	Forested ecosystems of floodplains that are briefly flooded (10–25 days) during freshet, allowing tree growth but forests are dominated by flood-tolerant broadleaf species such as black cottonwood and red alder.
Ga	**Grassland Alkali Meadow**	Grass-, rush-, or sedge-dominated ecosystems that occur in closed basins where high rates of evaporation lead to salt accumulate.
Gb	**Grassland Brushland**	Shrub ecosystems of very dry sites dominated (>10%) by drought tolerant woody shrubs of moderate stature.
Gg	**Grassland**	Graminoid dominated ecosystems that occur primarily on deep soils but sites are dry because of very rapid soil drainage, insulation, and/or lack of precipitation.
Gs	**Grassland Shrub Steppe**	Shrub ecosystems of hot semi-arid climates (BG, PP, driest IDF) dominated (>10%) by desert-adapted, drought and heat tolerant, medium stature woody shrubs.
Hh	**Halophyte**	Halophyte ecosystems occur in shallow closed basins in arid inland climates where evaporation leads to accumulation of salts.
Hs	**Spring-seepage**	Ecosystems on mineral springs and seeps that do not meet the criteria for wetland ecosystems.
Hv	**Vernal Pool**	Graminoid or Forb ecosystems of mediterranean climates that occur in shallow closed basins that contain water in the winter and early spring but dry out early in the growing season.
Hw	**Waterfall**	Highly localized ecosystems that occur at the edge of large waterfalls that create a spray zone that affects adjacent vegetation throughout the growing season.

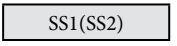
Code	Name	Description
Rc	**Cliff**	Ecosystems of vertical rocky sites commonly with high bryophyte cover (rock crusts) but small pockets of soils may support vascular vegetation.
Ro	**Rock Outcrop**	Rock outcrop ecosystems are bluffs and knobs of solid rock with limited soil development and high cover of exposed rock. Drought tolerant cryptogams are often prominent and vascular plants cover can be sparse.
Rt	**Talus**	Active and inactive talus (large rocks) and active scree (smaller rocks and more soil) ecosystems.
Sc	**Subalpine Shrub Carr**	Deciduous shrub-dominated ecosystem that develops on frost prone sites with dry to moist soils.
Sk	**Krummholz**	Conifer shrub-dominated ecosystem that occur at tree line, the upper elevations of conifer tolerance.
Ss	**Subalpine Shrub Seepage**	Shrub-dominated ecosystem of cold climates on cold, moist to very moist soils.
Vh	**Avalanche Herb**	Forb-, dwarf shrub- or grass-dominated ecosystems in avalanche tracks
Vs	**Avalanche Shrub**	Shrub-dominated ecosystems in avalanche tracks.
Vt	**Avalanche Treed**	Treed ecosystems continually pruned by avalanche events and prevented from becoming forest.
Wa	**Wetland Alpine**	High elevation mineral wetland ecosystems of mixed low stature vegetation.
Wb	**Wetland Bog**	Shrubby or treed, nutrient-poor peatland ecosystem with distinctive communities of ericaceous shrubs and hummock-forming Sphagnum species adapted to highly acid and oxygen-poor soil conditions.
Wf	**Wetland Fen**	Shrubby or gramininoid peatland ecosystem where groundwater inflow maintains relatively high mineral content within the rooting zone.
Wm	**Wetalnd Marsh**	Shallowly flooded mineral wetland ecosystem dominated by emergent grass-like vegetation.
Ws	**Wetland Swamp**	Forested, treed, or tall-shrub, mineral wetland ecosystem dominated by trees and broadleaf shrubs on sites with a flowing or fluctuating, semi-permanent, near-surface watertable.
Ww	**Wetland Shallow Water**	Shallow water ecosystems dominated by rooted, submerged and floating aquatic plants.
Xh	**Disclimax Herb**	Lush forb-dominated ecosystems that occur at lower elevations in areas where site conditions or stand age cannot explain lack of tree cover.
Xs	**Disclimax Shrub**	Ecosystems dominated by shrubs in areas where site conditions or ecosystem age cannot explain lack of tree cover.

21. Transition/Distribution Codes

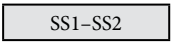
For descriptions of complex sites in projects involving systematic or random sampling, enter a one-digit code indicating the proportional distribution of site series within the plot and the presence of transitional site series. Note the specific transition condition in the "Plot Representing" field.

Mostly homogeneous plots (codes 1–3):

1 A simple homogeneous plot with > 98% of area classified as a single site series (SS1).



2 A homogeneous plot with > 90% of the area classified as SS1; however, site characteristics are grading slightly toward SS2. Less than 10% of the area is distinctly SS2.

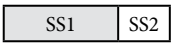


3 A homogeneous plot, but classification is intermediate between SS1 and SS2.

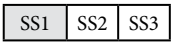
Transitional from one edge of the plot to the other (code 4):

4 Gradual transition from SS1 at one edge of plot to SS2 at other edge, or from SS2 to SS3, with SS1 being the modal site series. In the latter case, SS1 usually represents > 50% of plot.

Two or more distinct site series present (codes 5–8):



5 Two or more distinct site series present, with SS1 representing ≥ 70% of plot area.



6 Two or more distinct site series, with SS1 representing 40–69% of plot area.

7 Two distinct areas in the plot: SS1 represents ≥ 50% of area, and remainder is intermediate between SS2 and SS3.

8 Two distinct areas in the plot: ≥ 50% is intermediate between SS1 and SS2, and remainder is SS3.

22. Map Unit

If the plot is part of a mapping project, enter the coding for the applicable map attributes. These may include ecosystems, soils, terrain and/or wildlife attributes. An ecosystem mapping example is provided below::

Site series	Site modifier	Structural stage
SS	**mm**	**#xx**

23. Moisture Regime

Enter a code (0–8) for moisture regime. Base the assessment on environmental factors, soil properties, and indicator plants relative to other sites within same bio-geoclimatic unit. Classes are listed with brief descriptions in Table 1.1. Refer to Keys and Codes (9.2, 9.3, and 9.4) for some tools for estimating soil moisture regime. Note the following special cases:

- If two or more areas of the plot have a distinctly different moisture regime, enter codes for the dominant and largest sub-dominant class, with the sub-dominant class in parentheses (e.g., 4 (5)).
- Where moisture regime is *distinctly* transitional between two classes, indicate with "+" or "-" (e.g., 4+).

TABLE 1.1 Soil moisture regime classes [a]

Code	Class	Description	Primary water source
0	Very xeric	Water removed extremely rapidly in relation to supply; soil is moist for a negligible time after precipitation	Precipitation
1	Xeric	Water removed very rapidly in relation to supply; soil is moist for brief periods following precipitation	Precipitation
2	Subxeric	Water removed rapidly in relation to supply; soil is moist for short periods following precipitation	Precipitation
3	Submesic	Water removed readily in relation to supply; water available for moderately short periods following precipitation	Precipitation
4	Mesic	Water removed somewhat slowly in relation to supply; soil may remain moist for a significant, but sometimes short period of the year. Available soil moisture reflects climatic inputs	Precipitation in moderate- to fine-textured soils and limited seepage in coarse-textured soils

[a] More detailed descriptions and keys are given in the DEIF manual (Luttmerding et al. 1990) and in MFR field guides to site identification and interpretation.

TABLE 1.1 Soil moisture regime classes (continued)

Code	Class	Description	Primary water source
5	Subhygric	Water removed slowly enough to keep soil wet for a significant part of growing season; some temporary seepage and possibly mottling below 20 cm	Precipitation and seepage
6	Hygric	Water removed slowly enough to keep soil wet for most of growing season; permanent seepage and mottling; gleyed colours common	Seepage
7	Subhydric	Water removed slowly enough to keep water table at or near surface for most of year; gleyed mineral or organic soils; permanent seepage < 30 cm below surface	Seepage or permanent water table
8	Hydric	Water removed so slowly that water table is at or above soil surface all year; gleyed mineral or organic soils	Permanent water table

24. Nutrient Regime

Enter a code (A–F) for nutrient regime, indicating the available nutrient supply relative to other sites within the same biogeoclimatic unit. Base the assessment on a combination of environmental factors, soil properties, and indicator plants. Features that are strongly expressed may compensate for other factors to create richer or poorer conditions. Classes are listed with some criteria in Table 1.2. Refer to Keys and Codes (9.5, 9.6, 9.7, 9.8, and 9.9) for some tools for estimating soil nutrient regime.

- If two or more areas of plot have a distinctly different nutrient regime, enter the code for the dominant class, and give the range (e.g., C, B–C).
- Where the nutrient regime is *distinctly* transitional between two classes, enter closest class followed by an asterisk and explain under "Notes" (e.g. C*).

TABLE 1.2 Nutrient regime classes and relationships between nutrient regime and site properties

		A very poor	B poor	C medium	D rich	E very rich	F saline
Available nutrients		very low	low	average	plentiful	abundant	excess salt accum.
Humus form		**Mor**					
					Moder		
						Mull	
A horizon		**Ae horizon present**					
				A horizon absent			
					Ah horizon present		
Organic matter content		**low (light coloured)**					
			medium (intermediate)				
					high (dark coloured)		
C:N ratio		**high**					
				moderate			
					low		
Soil texture		**very coarse**	**coarse**	**medium**	**fine**	**very fine**	
Examples		LS, 60% CF		L, 25% CF	SiCl, 15% CF	SiC, 15% CF	
Slope position related to seepage		**upper**		**mid**		**lower**	
		shedding		normal		receiving	
Depth to impermiable layer		**shallow**		**medium**		**deep**	
		< 0.5 m		1–2 m		>2 m	
Coarse fragment type	**colour**	light		medium, mixed		dark unless calcareous	
	texture	coarse		medium		fine	
	hardness	hard		medium		soft	
	examples	granite quartzite sandstone	granodiorite	diorite schist argillite	gabbro	basalt slate limestone	
Soil pH		**extremely – mod. acid**					
			moderately acid-neutral				
					slightly acid – mildly alk.		
Water pH (wetlands)		<4–5	4.5–5.5	5.5–6.5	6.5–7.4	>7.4	
Seepage				**temporary** →		**permanent**	

Modified from Banner et al. 1993 and LMH25 1st Ed.

25. Successional Status

Successional status describes a temporal stage in a pathway of plant community development that is characteristic for a particular environment. The proportion of 'seral' species compared to 'climax' species, the vegetation layers in which these species occur, and the relative age and vigour of each species differentiates the stages. For determining successional status, 'seral' species are early- to mid-successional species that are replaced, in later stages, by 'climax', or late-successional species, i.e., species that can remain relatively stable in the stand over time.

The proportion of seral and climax species is used to characterize two generalized successional sequences. In the first, the early-successional species that establish following major disturbance develop through some mid-successional stages and are eventually replaced by climax species. When applied to forests, the stages of successional development in this sequence describe changes in both tree canopy species composition and tree species composition in the understorey. In the other sequence, 'climax' species colonize after disturbance and develop, through a series of stages that mostly describe community age and development. For example, a mature Douglas-fir stand is in mature seral stage if other species, e.g., western redcedar and hemlock, are regenerating in the understorey or a maturing climax stage if Douglas-fir is regenerating.

In areas of frequent stand-replacing disturbances, most forest stands do not reach the later stages of successional development and, therefore, the notion of successional development along a predictable sequence to a 'climax stage' may be somewhat theoretical – the potential development and replacement of early-successional species is evident in species composition of the vegetation layers, but may not often occur.

Similarly, in forest communities characterized by stand-maintaining or mixed severity disturbances, not all of the successional stages in a hypothetical sequence may occur because frequent disturbance events alter stand composition and development. However, successional development does occur and stands can be assigned a successional status based on relative species composition and stand age.

Although the successional status model was developed for forest communities, the principles can be applied, albeit more generally, to non-forested vegetation. For example, after a disturbance on a grassland site, species composition could develop from early- to mid- to late-successional species. That is, the community could transition from Sandberg's bluegrass to bluebunch wheatgrass, and then to rough fescue, and three stages could be recognized: pioneer seral, mature seral, and maturing climax. Alternatively, late-successional species may colonize and develop from a young climax stage to a maturing or old climax stage.

A climax community on a zonal site is termed a climatic climax. Edaphic climax communities are found on azonal sites, i.e., sites that are dryer or wetter than zonal; examples include: coarse-textured, glaciofluvial outwash; steep, warm aspect slopes; seepage slopes; wetlands.

When entering successional status on plot forms, record the two-character uppercase code. Use the 'Notes' section to elaborate on any difficulties in the determination. Note that stand ages may vary from the age ranges suggested here.

NV = Non-Vegetated:
Vegetation is either absent or less than five percent cover because of substrate conditions (e.g., down-slope movement, frost heaving) or recent severe disturbance such as fire, mass-wasting, flooding, or anthropogenic causes.

- Examples: active talus slope, recently deposited sandbar, mine tailings.

PS = Pioneer Seral:
Stage where vegetation occupies a site following either the elimination of the original plant cover by a disturbance such as fire, logging, or scalping of the soil surface, or the recent creation or exposure of parent material by mass wasting, glacier melt, flooding, or wind action (e.g., dunes).

- Herb or shrub species are usually dominant, but mosses, liverworts or lichens may dominate.
- Examples: fireweed community after a stand-destroying burn, grass-sedge community on recently-exposed glacial till.

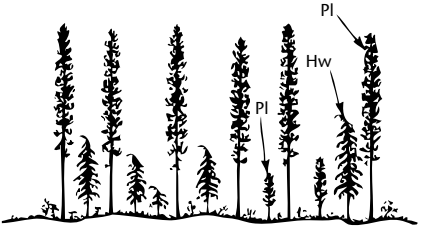
YS = Young Seral:
Community of early-successional species where competition has not imparted structural complexity to the community.

- Generally young stands (usually < 60 years old) of a single cohort of early-successional, shade-intolerant tree species with an even canopy height.
- Understorey vegetation may retain pioneer or 'disturbance' species, however, in dense stands, competitive exclusion of understorey will occur due to shading.
- Examples: lodgepole pine stand establishing after fire; western hemlock regenerating in recent clearcut.

Young seral stand

MS = Maturing Seral:
Community of early-successional tree species that have generally gone through an initial natural thinning due to species interactions such as within-stand competition for light or root-growing space, or a community where mid-successional species dominate. Very open stands may not go through a stem exclusion phase but could have a succession of understorey plant species occurring.

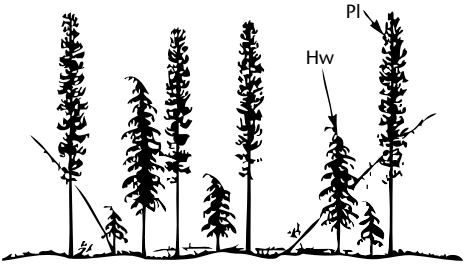
- Trees of mature age (generally 60–140 years old)
- Generally two cohorts: one in the overstorey and a younger one in the regeneration layer, usually of species with greater shade tolerance, but may include a component of species that are the same as the overstorey (e.g., fluvial cottonwood stands).
- Includes stands subject to frequent stand-replacing disturbances where regeneration to another cohort may be limited or absent, but where the stand has matured through natural thinning and development of the community, and the expected regeneration for the climate and ecosystem is to another, more shade-tolerant species.
- Examples: maturing Douglas-fir – western larch stand with western redcedar and western hemlock regenerating; maturing lodgepole pine stand in dry montane climatic zone with sparse hybrid white spruce and subalpine fir in understorey.



Maturing seral stand

OS = Overmature Seral:
Community where the seral overstorey species of the main upper canopy are dying.

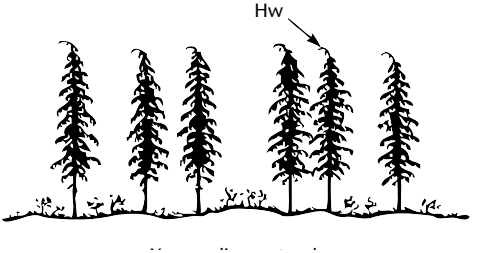
- Usually > 140 years old.
- Typically with a secondary tree canopy consisting of more shade-tolerant species, or some of the same species as those dying; some individuals belonging to the secondary cohort may have entered the main canopy.
- Example: well-developed hybrid white spruce cohort under an older lodgepole pine canopy that is failing due to age-based mortality or a mountain pine beetle attack.



Overmature seral stand

YC = Young Climax:
Community contains tree species typical of the climax expected for the site, but the proportional composition and structure expected at later climax stages has not developed; understorey seral species are usually still evident. This stage may follow the development and death of a stand of seral species or may develop from climax species regeneration on a recently disturbed site.

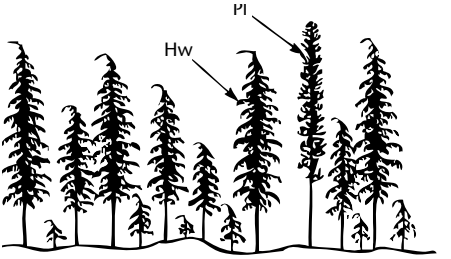
- In cases where climax tree species are the initial cohort, stands can be young (<30 years); this often occurs in wetter climates where stand-replacing fires are infrequent.
- Includes previously recognized Young Climatic Climax and Young Edaphic Climax stages.
- Examples: young subalpine fir – Engelmann spruce stand in a wet subalpine climate; young ponderosa pine stand in a dry climate where it would be the fire-maintained climax species; 50-60 year old hybrid white spruce stand 'released' from canopy of 100 year old lodgepole pine killed by mountain pine beetle.



Young climax stand

MC = Maturing Climax:
Community composed of species in proportions more or less typical of late succession for the site; the stand has undergone natural thinning, and vertical structure has developed, but lacks the complex structure typical of old forests.

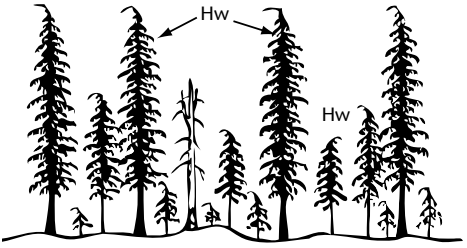
- Differs from YC in having a typical mature forest understorey herb and shrub community; stands are developing continuous diameter and height class distributions of climax tree species; seral species may still exist.
- Stands are at least 80–120 years old, but usually older.
- Includes previously recognized Maturing Climatic Climax and Maturing Edaphic Climax stages.
- Examples: mature western redcedar – western hemlock forest with component of Douglas-fir in canopy; mature hybrid white spruce on high-bench floodplain with a developing understorey of multiple cohorts of spruce regeneration.



Maturing climax stand

OC = Old Climax:
The plant community is composed of species expected to be present in the climax stand; vertical structure is well developed; live-tree decay is evident and tree death has led to canopy gaps and large woody debris on the forest floor; often with well-developed and distinct epiphytic communities.

- Occasionally, very long-lived seral species (e.g., Douglas-fir) are present, as a minor component of stand, but their removal would not cause a significant change in the growth or establishment of the climax trees.
- Differs from MC in having better-developed vertical and horizontal structure and a more or less continuous age and height class distribution of climax tree species.
- Stands are at least 250 years old, but often much older.
- Examples: very old coastal forests, including subalpine mountain hemlock – amabilis fir or hypermaritime western hemlock – western redcedar – yellow-cedar – shore pine; western redcedar – Devil's club forest with epiphytic stubble-lichens in interior rainforest climate.



Old climax stand

DC = Disclimax:
A persistent community that strongly differs in species composition from the edaphic or climatic climax expected for the site either due to repeated disturbance events or an historic disturbance event that, through "competitive exclusion" has halted succession. Disclimax should only be used for special situations where natural processes or events are holding "normal" succession at bay.

- The factor causing the disclimax condition often results in changes to the physical characteristics of the site (e.g., richer humus form);
- Examples: Avalanche tracks; steep slopes subject to constant surface raveling; heavily browsed communities; alder-swales in wet climates; sand dunes.

26. Structural Stage

Structural stage is used to describe the appearance of a stand or community using the characteristic life form and certain physical attributes. The stages can depict stand development features along a trajectory that is characteristic for the vegetation – e.g., development of a forest type, or refer to a certain type of vegetation, e.g., herb community.

Stand structure substages and additional modifiers can be used to better differentiate both non-forested categories (e.g., forb-dominated versus graminoid-dominated herb stage) and forested categories (e.g., single storied, multi-storied, coniferous versus broadleaf forests).

In the assessment of structural stage, structural features and age criteria should be considered. Use numeric and lowercase alphabetic codes for stages and substages. Modifiers for stand composition and canopy structure modifiers (Figure 1.2) are available to better describe stand conditions. For recording purposes, separate modifier codes from the structural stage code with a slash (e.g., 7a/Cm; 3b/B).

Post-disturbance stages, or environmentally limited structural development:

1 **Sparse/cryptogam**[1] Either the initial stages of primary succession, or a very early stage of cohort establishment following a stand-destroying disturbance, or a cryptogam community maintained by environmental conditions (e.g., bedrock, boulder fields, talus); bryophytes or lichens can be dominant; time since disturbance is < 20 years for normal forest succession; sparse tree, shrub and herb cover: either sparsely vegetated overall (low cover of vascular plants and cryptogams, if present), or dominated by cryptogams.

- **1a** **Sparse** – less than 10% vegetation cover.
- **1b** **Bryoid** – bryophyte-dominated.
- **1c** **Lichen** – lichen-dominated.

Stand initiation stages or environmentally induced structural development:

2 **Herb** Early successional stage or a herb community maintained by environmental conditions (e.g., very wet, warm & dry, or late snow site) or disturbance (e.g., avalanche track, flooding, intensive grazing, animal burrowing); generally dominated by herbs (forbs, graminoids, ferns), although herb cover can be low if sparsely vegetated overall as long as herbs characterize the vegetation; trees and shrubs are usually absent or sparse, however shrub cover and stature as compared to herb cover and stature determines whether the site is considered herbaceous; time since disturbance is < 20 years for normal forest succession; many non-forested communities are perpetually maintained in this stage.

- **2a** **Forb-dominated** – includes non-graminoid herbs and ferns.
- **2b** **Graminoid-dominated** – includes grasses, sedges, reeds, and rushes.
- **2c** **Aquatic** – floating or submerged plants dominate; (sedge communities growing in marshes with standing water are classed as 2b).
- **2d** **Dwarf shrub-dominated** – dominated by dwarf woody species such as kinnikinnick, dwarf willows, or mountain-heathers (see Table 3.1 in Vegetation section).

3 Shrub/Herb Early successional stage or a shrub community maintained by environmental conditions (e.g., wet soils, cold air accumulation) or disturbance (e.g., avalanche track); tree cover sparse but tree seedlings and advance regeneration may be abundant; either dominated by shrubby vegetation, or if sparsely vegetated overall, shrub cover and stature characterizes the community as a shrubland.

- **3a** **Low shrub** – dominated or characterized by shrubby vegetation < 2 m tall; time since disturbance < 20 years for normal forest succession; may be perpetuated indefinitely by environmental conditions (e.g., cold air basins) or disturbance.

1 Cryptogam: Term generally refers to plants that reproduce by spores – it is used here to refer to lichens, mosses and liverworts.

3b **Tall shrub** – dominated or characterized by shrubby vegetation that is 2–10 m tall; time since disturbance < 40 years for normal forest succession; may be perpetuated indefinitely.

Stem exclusion stages:

4 **Pole/Sapling** Trees > 10 m tall, typically densely stocked, and have overtopped shrub and herb layers; younger stands are vigorous (usually > 15–20 years old); older stagnated stands (up to 100 years old) are also included; self-thinning and vertical structure are not yet evident in the canopy; time since disturbance usually < 40 years; up to 100+ years for dense (5000 – 15000+ stems per ha) stagnant stands.

5 **Young Forest** Self-thinning has become evident and the forest canopy has begun to differentiate into distinct layers (dominant, main canopy, and overtopped); vigorous growth and a more open stand than in the Pole/Sapling stage; begins as early as age 30 (e.g., broadleaf or vigorous conifer stands) and extends to 50–80 years, depending on tree species and ecological conditions; in forest stands at environmental extremes, a very open Young Forest structure may develop initially (single cohort) or over a period of time (multi-cohort) – use the 'open' modifier for such conditions.

Understorey reinitiation stage:

6 **Mature Forest** Trees established after the last stand-replacing disturbance have matured; a second cycle of shade-tolerant trees may have become established; shrub and herb understories become well developed as the canopy opens up; time since disturbance is generally 80–140 years for BGCs with Natural Disturbance Type (NDT) 3[2] and 80–250 years for NDT 1, 2 & 4[3]. See BECdb database[4] for the current NDTs.

Old-growth stages:

7 **Old Forest** Stands of old age with complex structure; patchy shrub and herb understories are typical; regeneration is usually of shade-tolerant species with composition similar to the overstorey; long-lived seral species may be present in some ecosystem types or on edaphic sites. Old growth structural attributes will differ across biogeoclimatic units and ecosystems.

2 NDT 3 BGC units include all biogeoclimatic units within the following zones or subzones, as well as the specific variants: BWBS, MS, SBPS, ESSFdc, ESSFdk, ESSFdm, ESSFdv, ESSFxc, ICHdk, ICHdw, ICHdm, ICHmk1, ICHmk2, ICHmk4, ICHmw1, ICHmw3, ICHxw, SBSdh, SBSdk, SBSdw, SBSmc, SBSmh, SBSmk, SBSmm, SBSmw and SBSwk3.

3 NDT 1, 2 & 4 BGC units comprise all other biogeoclimatic units

4 BECdb database: http://www.for.gov.bc.ca/hre/becweb/resources/codes-standards/standards-becdb.html

7a **Old Forest** Stands with moderately to well developed structural complexity; stands comprised mainly of shade-tolerant tree species in canopy and regeneration layers, although older seral trees from a disturbance such as fire may still dominate the upper canopy; fire-maintained stands may have a 'single-storied' appearance (see modifiers); time since stand-replacing disturbance is generally 140 – 250 years for biogeoclimatic units with Natural Disturbance Type (NDT) 3[2] and > 250 years for NDT 1, 2 & 4.[3] See BECdb database[4] for the current NDTs.

7b **Very Old Forest** Very old stands having complex structure with abundant large-sized trees, snags and coarse woody debris (size is relative to the specific ecosystem); snags and CWD occur in all stages of decomposition; stands are comprised entirely of shade-tolerant overstorey species with well-established canopy gaps; time since stand-replacing disturbance generally > 250 years for BGCs with Natural Disturbance Types (NDT) 3[2] and > 400 years for NDT 1, 2 & 4.[3]

Structural stage modifiers Modifiers for stand composition, canopy structure, and disturbance history can be used to provide additional information for characterizing stands. For example, 6/Coth – describes an open, two-storied, silviculturally-modified mature coniferous forest structural stage.

Stand composition modifiers (stages 3–7 only) A description of the leaf-types of trees in a stand provides general information on the appearance and structure of the stand and is helpful as a broad descriptor of stand composition.

C = coniferous (> 75% of total tree cover is coniferous)

B = broadleaf (> 75% of total tree cover is broadleaf)

M = mixed (neither coniferous or broadleaf account for > 75% of total tree cover)

Canopy structure modifiers (stages 4–7 only) (see Figure 1.2): Overstorey tree structure can vary within any given structural stage due to edaphic differences or disturbance history. Below-ground vs. above-ground competition may also result in different structural modifiers at the same stage of structural development. Below-ground competition is evident in very dry stands and results in very open stands.

s = single-storied Closed or open forest stand dominated by the overstorey crown class (dominant and co-dominant trees); intermediate and suppressed trees comprise less than 20% of all crown classes combined.[5]

t = two-storied Closed or open forest stand co-dominated by distinct overstorey and intermediate crown classes; the suppressed crown class is lacking or comprises less than 20% of all crown classes combined.[5]

m = multistoried Closed or open forest stand with all crown classes well represented; each of the intermediate and suppressed classes comprise greater than 20% of all crown classes combined.[5]

5 Based on either basal area or percent cover estimates.

o = open Forest stand with very open main and intermediate crown classes (totaling less than 25% cover); substantial understorey light levels commonly result in well-developed shrub and/or herb understorey.

Stand development modifier

h = anthropogenic[6] Recent human-induced modification to stand structure; can differentiate silvicultural interventions from natural stand development; apply only in relatively recently-modified stands where natural stand development processes (i.e., natural regeneration and mortality), have not progressed.

27. Stand Age

Record the approximate age of the stand based on tree cores, inventories, or other sources of information, where appropriate.

28. Elevation

Determine in the field using an altimeter or GPS. Record in *meters* with an estimate of accuracy.

29. Slope

Record *percent* slope gradient, measured with a clinometer or similar instrument.

30. Aspect

Record the orientation of the slope relative to true north, measured by compass, in *degrees*.

- Enter due north as 0°.
- For level ground, enter "999."

31. Mesoslope Position

Indicate the position of plot relative to the localized catchment area (see Figure 1.3).

CR Crest The generally convex uppermost portion of a hill; usually convex in all directions with no distinct aspect.

UP Upper Slope The generally convex upper portion of the slope immediately below the crest of a hill; has a specific aspect.

MD Middle Slope Area between the upper and lower slope; the surface profile is generally neither distinctly concave nor convex; has a straight or somewhat sigmoid surface profile with a specific aspect.

LW Lower Slope The area toward the base of a slope; generally has a concave surface profile with a specific aspect.

6 Structure is assumed to have developed through natural (non human-induced) disturbance and successional processes unless this modifier is used.

TO **Toe** The area demarcated from the lower slope by an abrupt decrease in slope gradient; seepage is typically present.

DP **Depression** Any area concave in all directions; may be at the base of a meso-scale slope or in a generally level area.

LV **Level** Any level meso-scale area not immediately adjacent to a meso-scale slope; the surface profile is generally horizontal and straight with no significant aspect.

GU **Gully** An area in a double toe slope position where the receiving area is also sloped (perpendicular to the toe slopes).

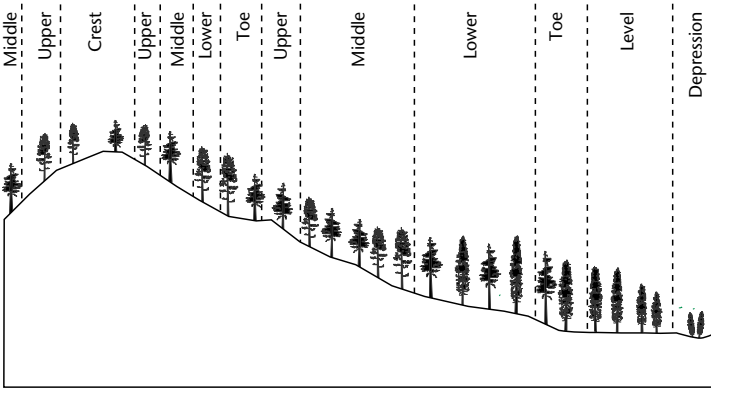


FIGURE 1.3 Mesoslope position.

32. Surface Shape

Note the general surface shape and the size, frequency, and type of microtopographic features. Describe to the level that best represents what you see, separating coding with periods (e.g., code a generally straight surface that is slightly mounded as **ST.sl.mnd** and a generally concave surface that is relatively flat as **CC.smo**).

General surface shape:

CC. **Concave** – surface profile is mainly "hollow" in one or several directions

CV. **Convex** – surface profile is mainly "rounded" like the exterior of a sphere

ST. **Straight** – surface profile is linear, either flat or sloping in one direction

33. Microtopography Type and Size

Size and frequency of microtopographic features:

mc. **micro** – low relief features (< 0.3 m high) with minimal effect on vegetation

sl. **slightly** – prominent features (0.3–1m high) spaced > 7 m apart

md. **moderately** – prominent features (0.3–1m high) spaced 3–7 m apart

st. **strongly** – prominent features (0.3–1m high) spaced 1–3 m apart

sv. **severely –** prominent features (0.3–1m high) spaced < 1 m apart

ex. **extremely** – very prominent features (> 1 m high) spaced > 3 m apart

ul. **ultra** – very prominent features (> 1 m high) spaced < 3 m apart

Types of microtopographic features:

cha **channelled** – incised water tracks or channels

dom **domed** – raised bogs

gul **gullied** – geomorphic ridge and ravine patterns

hmk **hummocked** – mounds composed of organic materials

lob **lobed** – solifluction lobes

mnd **mounded** – mounds composed of mineral materials

net **netted** – net vegetation patterns from freeze-thaw action in alpine or subarctic terrain

pol **polygonal** – polygonal patterns associated with permafrost

rib **ribbed** – wetland pattern with raised ridges perpendicular to direction of water flow

smo **smooth** – surface relatively flat

tus **tussocked** – associated with tussock-forming graminoids

und **undulating** – controlled by bedrock

34. Site Disturbance

Note any events that have caused vegetation and soil characteristics to differ from those expected at climax for the site. Be as specific as possible, including codes for the category and specific types of disturbance separated by periods. Record up to three different types of disturbance, separated by slashes. For example, enter **L.c./F.l.bb** for a clearcut that has been broadcast burned. If existing codes are inadequate, enter an "X" here and explain under "Notes."

A. Atmosphere-related effects

Use these codes if causative factors are no longer in effect or are isolated incidents. If effects are ongoing, code as an "Exposure Type" (Item 32).

e. climatic extremes

co extreme cold

ht extreme heat

gl glaze ice
ha severe hail
sn heavy snow

p. atmospheric pollution
ac acid rain
to toxic gases

w. windthrow

B. Biotic effects

b. beaver tree cutting
d. domestic grazing/browsing
w. wildlife grazing/browsing (5.1)[7]
e. excrement accumulation (other than that normally associated with grazing/browsing) (5.1)[7]
i. insects (4.2)[7]
ki insect kill
in infestation

p. disease (4.2)[7]
t. **turbation (soil)**
v. aggressive vegetation

D. Disposals

c. chemical spill or disposal
e. effluent disposal
g. domestic garbage disposal
o. oil spill or disposal
r. radioactive waste disposal or exposure

F. Fires

c. overstorey crown fire
g. light surface (ground) fire
r. repeated light surface fires
s. severe surface fire
i. repeated severe surface fires
l. burning of logging slash
bb broadcast burn
pb piled and burned
wb burned windrows

L. Forest harvesting

l. land clearing (includes abandoned agriculture)
a. patch cut system
wr with reserves

7 Record type or species under "Notes" using codes given in Item 9.21 of the Keys and Codes section or Appendix 5.1 of the Wildlife Habitat Assessment section.

- **c.** clearcut system (if slashburned, see also "Fires")
  wrwith reserves (patch retention)
- **d.** seed tree system
  - **un** uniform
  - **gr** grouped
- **e.** selection system
  - **gr** group selection
  - **si** single tree
  - **st** strip
- **s.** shelterwood system
  - **un** uniform
  - **gr** group
  - **st** strip
  - **ir** irregular
  - **na** natural
  - **nu** nurse tree
- **o.** coppice

M. Plant or site modification effects

- **c.** herbicide use (chemical)
- **f.** fertilization (specify type under "Notes")
- **i.** irrigation
- **g.** seeded or planted to grasses
- **h.** seeded or planted to herbs
- **s.** planted or seeded to shrubs
- **t.** planted or seeded to trees

P. Gathering or removal of plant products

- **f.** firewood gathering
- **m.** mushrooms
- **o.** moss
- **s.** shrubs (e.g., salal, falsebox)
- **x.** other (specify under "Notes")

S. Soil disturbance

- **a.** cultivation (agricultural)
- **c.** compaction
- **g.** gouging (> 5 cm into mineral soil)
- **s.** scalping (forest floor removed)
- **f.** sidecast/fill
- **r.** road bed, abandoned
- **t.** railway, abandoned
- **e.** excavation
- **m**. mining effects
  - **pt** placer tailings
  - **rq** rock quarrying (including open pit mines)
  - **ta** tailings

p. mechanical site preparation
- **bb** brush blading
- **ds** drag scarification (anchor chain or shark fin)
- **dt** disc trenching
- **md** mounding
- **ps** patch scarification
- **vp** V-plowing
- **xx** other (specify under "Notes")

T. Terrain-related effects
- **a.** avalanche
- **d.** recent deglaciation
- **e.** eolian (active deflation or deposition)
- **s.** terrain failures (active/recent slumps, slides, solifluction, etc.)
- **v.** volcanic activity

W. Water-related effects
- **i.** inundation (including temporary inundation resulting from beaver activity)
- **s.** temporary seepage (usually artificially induced; excludes intermittent seepage resulting from climatic conditions)
- **d.** water table control (diking, damming)
- **e.** water table depression (associated with extensive water extraction from wells)

X. Miscellaneous
(For other disturbance types, enter "X" and describe under "Notes")

35. Exposure Type

Note significant localized atmospheric and climate-related factors reflected in atypical soil and/or vegetation features. If existing codes are inadequate, enter an "**X**" and explain under "Notes." If there is no evidence of exposure to anomalous conditions, enter **"NA**."

AT **Atmospheric toxicity** For example, where highly acid or alkaline precipitation, or chemically toxic fumes from industrial plants affect soil chemistry and morphology, and the type and growth form of vegetation.
- Soil indicators – unusually high or low pH values; accumulations of chemicals normally either absent or present in small quantities.
- Vegetation indicators – defoliated areas; diseased or dead standing species; presence of several species tolerant to abnormal chemical accumulations.

CA **Cold air drainage** Downslope areas through which cold air passes; often grade into frost pockets, but differ in that cold air does not accumulate in them. Soil and vegetation indicators are similar to those for "FR," but the influence of cold temperatures is usually not as pronounced.

FR **Frost** Cold air accumulation in depressions and valley bottoms associated with high night-time surface cooling and/or cold air drainage. Frost pockets are often surrounded by slopes leading to the higher elevations from which the cold air originates.

- Soil indicators – wet conditions and/or deep organic accumulations.
- Vegetation indicators – species normally found in colder conditions than those of the general area, such as *Abies lasiocarpa* in the IDF zone; the presence of frost-hardy shrubs and herbs, such as scrub birch, marsh cinquefoil, and/or shrubby cinquefoil; abundant frost cracks on the trunks of trees.

IN **Insolation** Sites subjected to radiant solar heating to a significantly greater degree than on associated flat or gently sloping ground. Generally on SE, S, and SW aspects with slopes > 20–50%, depending on climate.

- Soil indicators – weaker than average soil profile development, reflecting a drier environment, or occasionally soil profiles with darker-coloured surface horizons.
- Vegetation indicators – heat-tolerant species; reduced tree growth; slow or sparse tree regeneration; open crown cover, and tree regeneration in distinct age groups, reflecting a history of wetter and drier years.

RN **Localized rainshadow** Valleys that are protected from the prevailing winds so that they are significantly drier than surrounding areas.

- Soil indicators – weaker soil development resulting from less precipitation, or different soil development because of significantly different vegetation.
- Vegetation indicators – plant communities or species indicative of a drier local climate.

SA **Saltspray** Areas that receive saltspray from a marine environment, affecting the type and growth form of the vegetation, and the chemical and morphological characteristics of the soil.

- Soil indicators – high pH and conductivity, presence of white salt accumulations as distinct crystals, and weak profile development.
- Vegetation indicators – an abundance of salt-tolerant species, and slow growth of many species.

SF **Fresh water spray** Areas adjacent to waterfalls and large rapids that receive spray from the rushing water; the resulting vegetation is noticably different from other areas adjacent to the river or stream.

- Soil indicators – moister soils.

- Vegetation indicators – species characteristic of moister sites are present or more abundant.

SN **Snow accumulation** Areas that receive significantly more snow than surrounding areas, which results in different vegetation.

- Soil indicators – poorer soil development resulting from the shorter snow-free period, or moister soils because of the longer snow melt period.
- Vegetation indicators – species adapted to greater snow accumulations (i.e., resistant to breakage), or a shorter growing season; or vegetation displaying the effects of a shorter growing season more than in adjacent areas; or species or communities indicative of moister conditions because of greater snow melt.

WI **Wind** Site is directly influenced by strong winds; for example, on exposed mountain tops, along seashores or large lakes, or where "wind funnelling" occurs because of the convergence of valleys in the direction of wind flow.

- Soil indicators – weak soil development because of scalped (eroded) profiles; evidence of soil erosion on windward side and deposition on leeside; duning.
- Vegetation indicators – strongly reduced height growth and gnarled growth form with tree tops and branches oriented downwind; wind-shorn thickets of trees or shrubs (wind-shorn surface of vegetation follows the outline of any object providing wind protection).

X **Miscellaneous** – Describe under "Notes."

36. Surface Substrate

Enter the proportion of the ground surface covered by each class of substrate. The total for all six classes should sum to 100%. Enter "**0**" if a substrate class is not present. Classes are defined as follows:

Organic matter Surficial accumulations of organic materials, including the following:

- organic layers of any thickness overlying mineral soil; or >2cm thickness over gravels, cobbles, stones, or bedrock;
- layers of decaying wood < 10 cm thick;
- large animal droppings; and
- areas covered by mats of bunchgrasses (mats include L horizons).

- Areas of living grass or forb cover where mineral soil is visible between stems are classed as mineral soil, as are exposed Ah or Ap horizons.

Decaying wood Fallen trees, large branches on the ground surface, and partially buried stumps with an exposed edge.

- Does not include freshly fallen material that has not yet begun to decompose.
- May be covered with mosses, lichens, liverworts, or other plants.
- If an organic layer has developed over the wood, decaying wood must be ≥ 10 cm thick, otherwise it is classed as "organic matter."

Bedrock Exposed consolidated rock.

- May have a covering of live mosses, lichens, liverworts, or other epilithic plants.
- Does not qualify as bedrock if covered by unconsolidated mineral or *dead* organic material ≥ 2 cm in thickness.

Rock (cobbles and stones) Exposed unconsolidated rock fragments > 2mm (coarse fragments) in diameter.

- May be covered by mosses, lichens, liverworts; or an organic layer < 2 cm in thickness.

Mineral Soil Unconsolidated mineral material of variable texture not covered by organic materials.

- May have a partial cover of live mosses, lichens, and liverworts.
- Often associated with cultivation, tree tip-ups, active erosion or deposition, severe fires, trails, or late snow retention areas.

Water Streams, puddles, or areas of open water in bogs or fens.

37. Notes

Record additional information that:

- further characterizes the site;
- assists in finding the plot again;
- explains unusual entries elsewhere on the form; or
- relates to a particular project which is not accommodated elsewhere on the forms.

Appendix 1.1 Forest District Codes

Code	Forest District
RCO.DCK	Chilliwack
RCO.DCR	Campbell River
RCO.DHG	Haida Gwaii
RCO.DNC	North Coast
RCO.DNI	North Island - Central Coast
RCO.DSC	Sunshine Coast
RCO.DSI	South Island
RCO.DSQ	Squamish
RNI.DFN	Fort Nelson
RNI.DJA	Fort St. James
RNI.DKM	Kalum
RNI.DMK	Mackenzie
RNI.DND	Nadina
RNI.DPC	Peace
RNI.DPG	Prince George
RNI.DSS	Skeena Stikine
RNI.DVA	Vanderhoof
RSI.DAB	Arrow Boundary
RSI.DCC	Central Cariboo
RSI.DCH	Chilcotin
RSI.DCO	Columbia
RSI.DCS	Cascades
RSI.DHW	Headwaters
RSI.DKA	Kamloops
RSI.DKL	Kootenay Lake
RSI.DMH	100 Mile House
RSI.DOS	Okanagan Shuswap
RSI.DQU	Quesnel
RSI.DRM	Rocky Mountain

2 SOIL DESCRIPTION

Contents

Figures

SOIL DESCRIPTION

GEOLOGY BEDROCK (3) | C. F. LITH. (4) | **SURVEYOR(S)** (1) | **PLOT NO.** (2)

TERRAIN (5) TEXTURE 1 / 2 | SURFICIAL MATERIAL 1 / 2 | SURFACE EXPR. 1 / 2 | GEOMORPH. PROCESS 1 / 2 | **PROFILE DIAGRAM** (33)

SOIL CLASS. (6) . | **HUMUS FORM** (7) | PHASE | **HYDROGEO.** (8)

ROOTING DEPTH (9) cm | ROOT RESTRICT. LAYER TYPE / DEPTH (11) cm | WATER SOURCE (12) | DRAINAGE (14)

R. Z. PART. SIZE (10) | SEEPAGE (13) cm | FLOOD RG. (15)

ORGANIC HORIZONS/LAYERS

HOR/ LAYER (16)	DEPTH (17)	FABRIC STRUCTURE (18)	FABRIC vPOST	MYCEL. AB. (19)	FECAL AB. (20)	ROOTS AB. (21)	ROOTS SIZE	pH (22)	COMMENTS (consistency, character, fauna, etc): (23)

MINERAL HORIZONS/LAYERS

HOR/ LAYER (24)	DEPTH (25)	COLOUR (26)	ASP.	TEXT. (27)	% COARSE FRAGMENTS G	C	S	TOTAL (28)	SHAPE	ROOTS AB. (29)	ROOTS SIZE	STRUCTURE CLASS (30)	STRUCTURE KIND	pH (31)	COMMENTS (mottles, clay films, effervesc., etc): (32)

NOTES: (34)

FS882 (2) HRE 2008/03

Field Procedure

Getting Started

1. Locate plot boundaries, **assess variability**, select pit location(s).
2. Excavate pit (generally 50–75 cm in depth) leaving the face and sides undisturbed around the ground surface.
3. While excavating, **observe**:
   - organic horizon depths and fabric;
   - mineral horizon depths, colours, structure, and textural changes;
   - percentage and shape of coarse fragments;
   - rooting abundance, depth, and restrictions; and
   - mottling, water seepage, or water table.
4. Lay out notes, forms, and soil description tools.
5. Clean off face from top to bottom (and photograph if required).
   - Note horizon changes and mark with knife indentations or golf tees.
   - Collect soil texture samples from bottom to top and put aside.

Record and Classify

1. Designate horizons on form (organic and mineral horizons/layers).
   For each horizon (depending on survey objectives/requirements):
   - Record average starting and ending depths.
   - For organic horizon, record fabric, mycelia and fecal abundance, rooting, and pH.
   - For mineral horizons, hand-texture soil samples and determine colours. Record percent and shape of coarse fragments, rooting, structure, and pH.
   - Note important observations in comments (e.g. soil fauna, mottles, clay films, etc.).
   - Confirm original horizon designations.
2. Sketch a profile diagram to approximate scale.
3. Record:
   - rooting depth, particle size, and restricting layer
   - water source, seepage depth, drainage class, and flooding regime
4. Classify:
   - bedrock geology and coarse fragment lithology type(s)
   - terrain unit(s), soil pedon, humus form, and hydrogeomorphic unit

Use the "Notes" section to summarize or describe important soil features not otherwise collected on the form, or are significant to the study, classifications, or management interpretations.

Check and Integrate

Check the form to ensure there are no missing data, and then (under most circumstances) fill in the pit. Strike through any fields that were not assessed. Integrate the soil data with other site and vegetation factors to determine and record the soil moisture and soil nutrient regimes on the site description form.

Completing the Form

Numbered items below refer to circled numbers on the Soil Description Form shown at the beginning of this section. See "Field Procedure" for a recommended sequence for completing the form.

1. Surveyor

Indicate the first initial and last name of the person(s) who described and classified the soil profile.

2. Plot Number

Record the plot number from the top of the Site Description Form.

3. Bedrock Type

Record general or specific codes (see Tables 2.1, 2.2, 2.3) for up to three rock types in the underlying bedrock, in order of dominance if possible. This is particularly important on sites with shallow soils or bedrock exposure. Refer to Keys and Codes (9.11 and 9.12) for keys to common rock types.

TABLE 2.1 Sedimentary rock codes

	General	Code	Specific	Code
Clastic, calcareous	Fine grained	**kf**	Calcareous Siltstone Calcareous Mudstone Calcareous Shale	**kz** **kd** **kh**
	Medium grained	**km**	Calcareous Greywacke Calcareous Arkose Calcareous Sandstone	**kg** **ka** **ks**
	Coarse grained	**kc**	Calcareous Conglomerate Calcareous Breccia	**kn** **kb**
Clastic, non-calcareous	Fine grained	**uf**	Siltstone Mudstone Shale	**zl** **md** **sh**
	Medium grained	**um**	Sandstone Greywacke Arkose	**ss** **gk** **ak**
	Coarse grained	**uc**	Conglomerate Breccia	**cg** **bx**
Precipitates, crystalline	Calcareous	**pk**	**Travertine** Limestone Dolomite	**tv** **ls** **do**

TABLE 2.1 Sedimentary rock codes (continued)

	General	Code	Specific	Code
	Non-calcareous	**pu**	Gypsum	**gy**
			Limonite	**li**
			Barite	**ba**
Organic	Calcareous	**ok**	Mar	**ma**
	Carbonaceous	**oc**	Lignite	**lg**
			Coal	**co**

TABLE 2.2 Igneous rock codes

	General	Code	Specific	Code
Intrusive	Acid (felsic)	**ia**	Syenite	**sy**
			Granite	**gr**
			Quartz Monzonite	**qm**
			Granodiorite	**gd**
	Intermediate	**ii**	Quartz Diorite	**qd**
			Diorite	**di**
	Basic (mafic)	**ib**	Quartz	**qg**
			Gabbro	**gb**
			Pyroxenite	**py**
			Dunite	**du**
Extrusive	Acid (felsic)	**ea**	Trachyte	**tr**
			Rhyolite	**rh**
			Dacite	**da**
	Intermediate	**ei**	Andesite	**an**
	Basic (mafic)	**eb**	Quartz Basalt	**qb**
			Basalt	**bs**
	Recent lava flow	**la**		
	Pyroclastic	**ep**	Tuff	**tu**
			Volcanic Breccia	**vb**
			Agglomerate	**ag**

TABLE 2.3 Metamorphic rock codes

	General	Code	Specific	Code
Foliated	Fine grained	**ff**	Slate	**sl**
			Phylite	**ph**
	Medium to coarse grained	**fm**	Schist	**sc**
			Gneiss	**gn**
			Granite Gneiss	**gg**
			Diorite Gneiss	**dg**
	Coarse grained	**fc**	Migmatite	**mi**
Non-foliated	Fine grained	**nf**	Argillite	**ar**
			Serpentinite	**sp**
	Medium to coarse grained	**nm**	Quartzite	**qt**
			Hornfels	**hf**
			Granulite	**gl**
	Coarse grained	**nc**	Amphibolite	**am**
			Hornblendite	**hb**
	Calcareous	**nk**	Marble	**mb**
			Dolomite Marble	**dm**
			Serpentine Marble	**sm**

4. Coarse Fragment Lithology

Record up to three rock types in order of dominance from left to right on the form that make up the coarse fraction (i.e., gravels, cobbles, and stones) of the soil material. Characters are recorded using the same codes as outlined for bedrock type. If the lithologies are so mixed that dominance can not be determined, record by entering the code "**mx**."

5. Terrain Classification

Fields are provided for recording terrain texture, surficial material, surface expression and geomorphological process for two stratigraphic layers (Howes and Kenk 1997) (see Tables 2.4, 2.5, 2.6, and 2.7 and Figure 2.1). Up to three codes can be entered in each of these fields. Place qualifying descriptor codes (Table 2.8) in the appropriate field to the right of any other codes used in that field (superscript codes are no longer used). Code line 1 for the uppermost stratigraphic layer, and code line 2 for an underlying layer. For those wishing to use terrain subclasses and subtypes, refer to Howes and Kenk (1997). Refer to Keys and Codes (section 9) for keys to surficial material (9.3) and surface expression (9.4).

TABLE 2.4 Terrain texture codes

Code	Name	Size (mm)	Other Characteristics
a	Blocks	> 256	Angular particles
b	Boulders	> 256	Rounded and subrounded particles
k	Cobble	64–256	Rounded and subrounded particles
p	Pebbles	2–64	Rounded and subrounded particles
s	Sand	0.062–2.000	
z	Silt	0.002–0.062	
c	Clay	< 0.002	
d	Mixed fragments	> 2	Mix of rounded and angular particles
g	Gravel	> 2	Mix of boulders, cobbles, and pebbles
x	Angular	> 2	Mix of blocks and rubble
r	Rubble	2–256	Angular particles
m	Mud	< 0.062	Mix of clay and silt
y	Shells	—	Shells or shell fragments
e	Fibric	—	Well-preserved fibre; (40%) identified after rubbing
u	Mesic	—	Intermediate composition between fibric and humic
h	Humic	—	Decomposed organic material; (10%) identified after rubbing

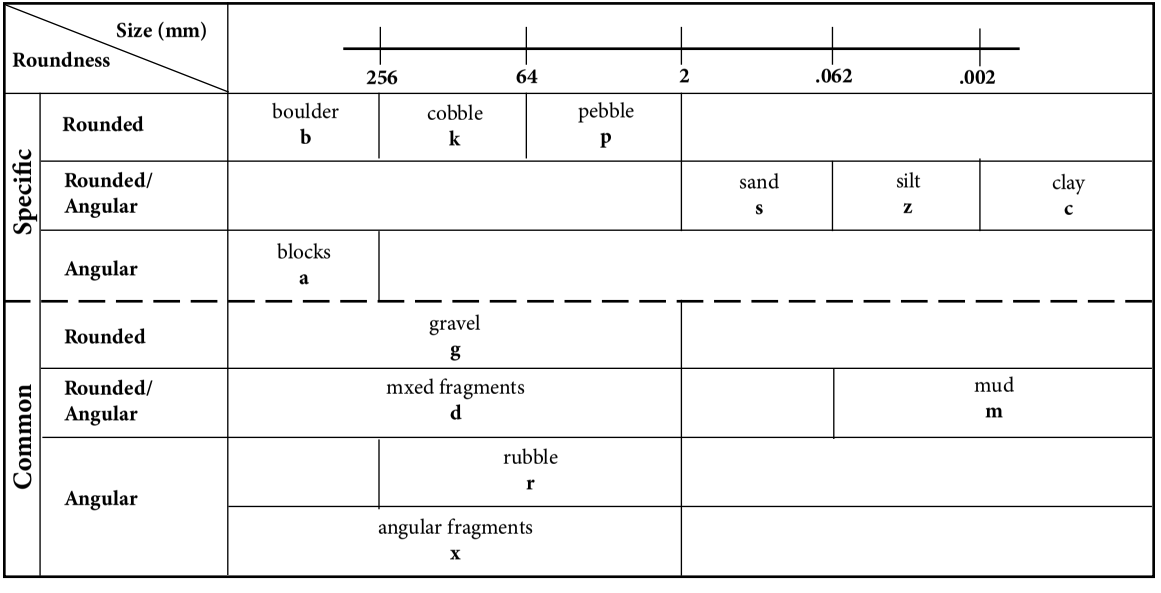


FIGURE 2.1 Terrain texture codes: Relationship of size and roundness of the clastic textural terms.

TABLE 2.5 Surficial (genetic) material codes

Code	Name	(Assumed status)	Description
A	Anthropogenic	(A)	Artificial or human-modified material
C	Colluvium	(A)	Products of mass wastage
D	Weathered bedrock	(A)	*In situ*, decomposed bedrock
E	Eolian	(I)	Materials deposited by wind action
F	Fluvial	(I)	River deposits
FG	Glaciofluvial	(I)	Ice contact fluvial material
I	Ice	(A)	Permanent snow, glaciers, and icefields
L	Lacustrine	(I)	Lake sediments; includes wave deposits
LG	Glaciolacustrine	(I)	Ice contact lacustrine material
M	Morainal	(I)	Material deposited directly by glaciers
O	Organic	(A)	Accumulation/decay of vegetative matter
R	Bedrock	(–)	Outcrops/rocks covered by less than 10 cm of soil
U	Undifferentiated	(–)	Layered sequence; three materials or more
V	Volcanic	(I)	Unconsolidated pyroclastic sediments
W	Marine	(I)	Marine sediments; includes wave deposits
WG	Glaciomarine	(I)	Ice contact marine sediments

TABLE 2.6 Surface expression codes

Code	Name	Description
a	Moderate slope	Unidirectional surface; > 25% to < 50%
b	Blanket thick	A mantle of unconsolidated materials; > 1 m
c	Cone(s)	A cone or segment of a cone; > 25%
d	Depression(s)	A lower area surrounded by a higher terrain
f	Fan(s)	A segment of a cone; up to 15°
h	Hummock(s)	Hillocks and hollows, irregular in plan; 25% – 70%
j	Gentle slope	Unidirectional surface; > 5% and < 25%
k	Moderately steep slope	Unidirectional surface; > 50% and < 70%
m	Rolling	Elongate hillocks; 5–25%; parallel forms in plan view
p	Plain	Unidirectional surface; up to 5%
r	Ridge(s)	Elongate hillocks; 25–70%; parallel forms in plan view
s	Steep slope	Steep slopes; > 70%
t	Terrace(s)	Step-like topography
u	Undulating	Hillocks and hollows; up to < 25%; irregular in plan view
v	Veneer	Mantle of unconsolidated material; 0.1 to 1.0 m thick
w	Mantle of variable thickness	A layer or discontinuous layer of surficial materials of variable thickness that fills or partially fills depressions in an irregular substrate. The thickness ranges from 0 to 3 m.
x	Thin veneer about 2–20 cm thick	A dominance of very thin surficial materials

TABLE 2.7 Geomorphological process codes

Code	Name	(Assumed status)	Description
A	Avalanches	(A)	Terrain modified by snow avalanches
B	Braiding	(A)	Diverging/converging channels; unvegetated bars
C	Cryoturbation	(A)	Materials modified by frost heaving and churning
D	Deflation	(A)	Removal of sand and silt by wind action
E	Channeled	(I)	Channel formation by meltwater
F	Slow mass	(A)	Slow downslope movement of masses of cohesive or non-cohesive material
H	Kettle	(I)	Depressions in surficial material resulting from the melting of buried or partially buried glacier ice
I	Irregular channel	(A)	A single, clearly defined main channel displaying irregular turns and bends
J	Anastomosing channel	(A)	A channel zone where channels diverge and converge around many vegetated islands
K	Karst	(A)	Processes associated with the solution of carbonates
L	Surface seepage	(A)	Zones of active seepage often found along the base of slope positions
M	Meandering channels	(A)	Channels characterized by a regular pattern of bends with uniformed amplitude and wave length
N	Nivation	(A)	Erosion beneath and along the margin of snow patches

TABLE 2.7 Geomorphological process codes (continued)

Code	Name	(Assumed status)	Description
P	Piping	(A)	Subterranean erosion by flowing water
R	Rapid mass movement	(A)	Rapid downslope movement of dry, moist, or saturated debris
S	Solifluction	(A)	Slow downslope movement of saturated overburden across a frozen or otherwise impermeable substrate
U	Inundation	(A)	Seasonally under water because of high water table
V	Gully erosion	(A)	Parallel/subparallel ravines caused by running water
W	Washing	(A)	Modification by wave action
X	Permafrost	(A)	Processes controlled by the presence of permafrost
Z	Periglacial processes	(A)	Solifluction, cryoturbation, and processes nivation occurring within a single unit

TABLE 2.8 Qualifier codes

Code	Name	Description
A	Active	Used to qualify surficial material and geomorphological processes with regard to their current state of activity.
I	Inactive	

6. Soil Classification

The Canadian System of Soil Classification (Soil Classification Working Group, 1998) is tabulated alphabetically by soil order. Codes for great groups and subgroups are given in 9.18. The Keys and Codes (section 9) includes keys to soil orders (9.17) and soil great groups and subgroups (9.18). For those wishing to use family and phase criteria, refer to Soil Classification Working Group (1998) and include in "Notes."

7. Humus Form and Phases

Humus forms are classified to order and group according to *Towards a Taxonomic Classification of Humus Forms* (Green et al. 1993). Use Table 2.9 to enter codes. The Keys and Codes (section 9) includes a key to humus forms (9.16). For those wishing to use phases, refer to Table 2.10 and enter code under Phase subfield.

TABLE 2.9 Codes for humus orders and groups

Order	Group	Code
MOR		**R**
	Hemimor	**HR**
	Humimor	**UR**
	Resimor	**RR**
	Lignomor	**LR**
	Hydromor	**YR**
	Fibrimor	**FR**
	Mesimor	**MR**
MODER		**D**
	Mormoder	**RD**
	Leptomoder	**TD**
	Mullmoder	**MD**
	Lignomoder	**LD**
	Hydromoder	**YD**
	Saprimoder	**SD**
MULL		**L**
	Vermimull	**VL**
	Rhizomull	**ZL**
	Hydromull	**YL**

Table 2.10 Humus Phases

Code	Name	Description
an	Andic	Presence of volcanic ash (all)
ca	Calcic	Enriched with calcium; Ahk horizon and underlain with calcareous parent material (Mulls and Mullmoders)
ch	Charcic	>35% volume of charcoal in humus profile (all)
cl	Clastic	>35% volume of coarse fragments in humus profile (Mors and Moders)
co	Compactic	High density humus forms, typical of high snowfall areas (Mors)
cs	Crustic	Upper horizons with dry brittle firm fabric, typically on xeric sites (Mors and Moders)
cy	Cryic	Directly influenced by permafrost (all)
gr	Granuic	H horizon with strong granular structure (Mors)
hi	Histic	O horizons comprise 25-50% thickness of humus (Hydromors and Hydromoders)
la	Lammic	Mormoders with Fm horizon, Leptomoders with Fm or Fa horizon
li	Lignic	>35-80% volume of wood (hydromorphic Mors)
me	Melic	Well developed LFH and Ah horizons (Mors and Moders)
mi	Mineric	Significant intermixed mineral soil particles in humus form (Mors and Moders)
my	Mycic	Presence of a horizon comprised almost entirely of fungal mycelia (Mors)
pa	Pachic	Atypically thick forest floor (Mors and Moders)
re	Resic	Presence of continuous Hr horizon but <50% thickness of combined F and H horizons (Mors)
rh	Rhizic	Presence of Ah horizon derived from decomposition of fine herbaceous roots (Moders)
te	Tenuic	Atypically thin forest floor (Mors and Moders)
tu	Turbic	Humus form markedly disturbed by physical processes (all)
us	Ustic	Recently affected by fire; blackened crusty surface horizon (all)
vl	Velic	Initial stage of humus development; LFH is >80% of humus thickness (Mors and Moders)
vr	Vermic	Earthworms and casts common in the humus form profile (Moders and Mulls)
xy	Xylic	>80% volume of wood in the humus form profile (Mors and Moders)

8. Hydrogeomorphic Units

The *system* defines broad hydrological processes which characterize landscape units and ecosystems by water sources and hydrodynamics. *Element groups* divide a system by patterns of waterflow which indicate generically hydrodynamics, water source, and connectivity in the landscape. Record the system code first and modifier (where applicable) followed by the element group code (e.g., Fra= alluvial river). Use the codes in Tables 2.11 and 2.12.

TABLE 2.11 Codes for hydrogeomorphic systems

Code	Name	Description
L	Lacustrine	Occurs adjacent to lakes and ponds and is directly affected by lacustrine processes (e.g., wave action, sedimentation, and relatively high nutrient content of flood waters).
P	Palustrine	Occurs in basins and depressions with poor drainage that collect water flows from runoff, groundwater, and precipitation. Often peatlands, ponds, and marshes.
F	Fluvial[a]	Occurs along flowing water courses, the water course itself, and the surrounding (riparian) terrain and vegetation. Subject to flooding and sedimentation processes.
U	Upland	Occurs in sloping, level, and depressional sites not described by other hydrogeomorphic systems.
E	Estuarine	Consists of intertidal habitats where ocean water is at least occasionally diluted by freshwater runoff from the land. Occurs at the confluence of rivers and ocean and has characteristics that reflect the flooding and salinity gradients found there.
M	Marine	Exposed to waves and currents of the open ocean. Water regimes are determined primarily by the ebb and flow of oceanic tides.

[a] Modifiers: **r** = river (20 m+ wide); **s** = stream (5–20 m); **c** = creek (1.5–5 m); **v** = rivulet (< 1.5 m).

TABLE 2.12 Codes for hydrogeomorphic subsystems

System	Element Group	Code	Description
Lacustrine or palustrine; confined basins	Closed basin	**cb**	Basin receives water from surrounding upland only, no inlet or outlet channel.
	Overflow basin	**ob**	Basin receives water from upland only; excess water flows through an outlet channel.
	Linked basin	**lb**	Basin receives water from upland and an inflow stream; excess water flows though an outflow. Includes basins with slow streams where there is little sedimentation or erosion.

TABLE 2.12 Codes for hydrogeomorphic subsystems (continued)

System	Element Group	Code	Description
	Terminal basin	**tb**	Basin receives water from upland and an inflow stream; no outlet channel.
Palustrine; unconfined slopes and hollows	Overflow hollow	**oh**	Hollow receives ground water from upslope; drains through outlet channel or watertrack.
	Linked hollow	**lh**	Hollow receives water from upland and an inflow stream; excess water flows out through an outflow stream or watertrack. Includes gullies with slow streams where there is little sedimentation or erosion.
	Blanket slope	**bs**	Occurs in subdued topography where basin types are not defineable.
	Toe slope	**ts**	Occurs on toe slope positions not confined by basin or hollow; water received from upslope, sheet or channelled flow.
	Lobe slope	**ls**	Peatlands on slopes with a downslope edge elevated above the upland in the form of a lobe; water received from upslope, sheet or channelled flow.
Fluvial	Alluvial	**a**	Associated with low-gradient streams where floodplain building processes predominate; flooding and subsequent deposition of alluvium leads to extensive floodplains of sandy or silty soils.
	Transport	**t**	Associated with moderate gradient streams where neither erosion or deposition forces predominate; floodplain development limited, in-stream bars and gravelly soil common.
	Headwater	**h**	Associated with high gradient streams where erosive processes predominate; flood plain and bar development limited; cobble, stone or bedrock substrates common.

9. Rooting Depth

Rooting depth refers to the depth (cm) from the *ground surface,* which is the top of the uppermost soil horizon including organic horizons (e.g., Fm1), down to the bottom of the rooting zone (i.e., the level at which the majority of roots stop; for example, the end of "plentiful" and beginning of "few" rooting abundance).

10. Rooting Zone Particle Size

The particle size distribution within the mineral portion of the rooting zone is used to make broad interpretations. After determining rooting depth, estimate the rooting zone particle-size class as a weighted average of the mineral horizons within the rooting zone (Figure 2.2, Table 2.13). Where rooting is restricted to the organic horizons, use the organic material codes in Table 2.13. For the most part, class names and definitions have been modified from the Canadian System of Soil Classification family particle size criteria. Rooting zone classes are greatly simplified and use only percent coarse fragments (≥ 2 mm) by volume, and texture class sizes by percent weight for sand (.05 to < 2 mm), silt (< .05 to .002 mm), and clay (< .002). Two different classes can be entered on the data form if strongly contrasting size classes occur (e.g. CLS/FC= coarse-loamy over fine-clayey), however ranges of rooting zone particle-size classes can not be shown.

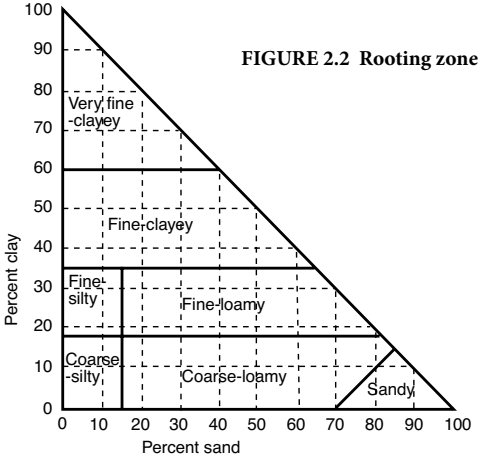


FIGURE 2.2 Rooting zone particle size classes.

TABLE 2.13 Rooting zone particle size classes

Code	Class[a]	Definitions	
Coarse fragments ≥70%			
F	Fragmental	Particles <2 mm of various textures	
Coarse fragments ≥35 and less than 70%			
SS	Sandy-skeletal	Particles <2 mm sandy	
CLS	Coarse-loamy-skeletal	Particles <2 mm coarse-loamy	
FLS	Fine-loamy-skeletal	Particles <2 mm fine-loamy	
SIS	Silty-skeletal	Particles <2 mm fine-silty or coarse-silty	
CS	Clayey-skeletal	Particles <2 mm clayey	
Coarse fragments ≥35 and less than 70%			
S	Sandy	Organic Material Codes:	
CL	Coarse-loamy	**FI**	Fibric
FL	Fine-loamy	**ME**	Mesic
CSI	Coarse-silty	**HU**	Humic
FSI	Fine-silty	**WO**	Woody
FC	Fine-clayey		
VFC	Very-fine-clayey		
Substitute Classes for Volcanic and Thixotropic soils			
Ci	Cindery	>60% of the soil consists of volcanic ash and cinders; >35% of cinders >2mm	
A	Ashy	>60% of soil consists of volcanic ash and cinders; <35% of cinders >2mm	
AS	Ashy-skeletal	Ashy with >35% non-cinder particles > 35% by volume	
T	Thixotropic	Soils liquify on agitation and resume solid state when undisturbed; <35% particles >2mm	
TS	Thixotropic-skeletal	Soils liquify on agitation and resume solid state when undisturbed; >35% particles >2mm	

[a] Refer to triangle in Figure 2.2 for proportion of sand and clay in the fine particle sizes (<2 mm) of these classes.

11. Root Restricting Layer

If present, enter a code for the type of root restricting layer (Table 2.14), and the depth (cm) from the *ground surface* down to the top of the layer.

TABLE 2.14 Codes for root restricting layers

Code	Description
C	Strongly cemented horizon
P	Clay pan or restriction due to fines
K	Compacted morainal material
L	Lithic contact
W	Excessive moisture; this refers to the depth where the roots are being restricted by excessive moisture, but does not require the presence of free water at the time of sampling
X	Excessive accumulations of chemicals within the profile which inhibit root growth (i.e., $CaCO_3$)
Z	Permafrost; characterized by temperatures never exceeding 0°C, ice cementation, ice lenses, or massive ice
N	No root restriction evident

12. Water Source

The most influential source of water on a site (determined by a qualitative assessment) is recorded using the codes in Table 2.15.

TABLE 2.15 Water source codes

Code	Water Source
P	Precipitation
G	Groundwater
S	Snowmelt (prolonged through the growing season)
F	Stream sub-irrigation and flooding
M	Mineral spring
T	Tidal, freshwater
E	Tidal, saltwater
Z	Permafrost

13. Seepage Water Depth

If seepage is present at the time of sampling, record the depth (cm) from the *ground surface* to the level of temporary or permanent subsurface water flow. Enter "**999**" if not present.

14. Drainage Class and Soil Moisture Subclass

Drainage class describes the speed and extent to which water is removed from a mineral soil in relation to additions. Enter the code which best describes growing season conditions (Table 2.16.) The Keys and Codes (section 9) includes a Soil Drainage Classs Key (9.15).

TABLE 2.16 Drainage classes and codes

Code	Name	Description
x	Very rapidly drained	Water is removed from the soil very rapidly in relation to supply. Water source is precipitation and available water storage capacity following precipitation is essentially nil. Soils are typically fragmental or skeletal, shallow, or both.
r	Rapidly drained	Water is removed from the soil rapidly in relation to supply. Excess water flows downward if underlying material is pervious. Subsurface flow may occur on steep gradients during heavy rainfall. Water source is precipitation. Soils are generally coarse textured.
w	Well drained	Water is removed from the soil readily, but not rapidly. Excess water flows downward readily into underlying pervious material or laterally as subsurface flow. Water source is precipitation. On slopes, subsurface flow may occur for short durations, but additions are equalled by losses. Soils are generally intermediate in texture and lack restricting layers.
m	Moderately well drained	Water is removed from the soil somewhat slowly in relation to supply because of imperviousness or lack of gradient. Precipitation is the dominant water source in medium- to fine- textured soils; precipitation and significant additions by subsurface flow are necessary in coarse-textured soils.

Code	Name	Description
i	Imperfectly drained	Water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season. Excess water moves slowly downward if precipitation is the major source. If subsurface water or groundwater (or both) is the main source, the flow rate may vary but the soil remains wet for a significant part of the growing season. Precipitation is the main source if available water storage capacity is high; contribution by subsurface or groundwater flow (or both) increases as available water storage capacity decreases. Soils generally have a wide range of texture, and some mottling is common.
p	Poorly drained	Water is removed so slowly in relation to supply that the soil remains wet for much of the time that it is not frozen. Excess water is evident in the soil for a large part of the time. Subsurface or groundwater flow (or both), in addition to precipitation, are the main water sources. A perched water table may be present. Soils are generally mottled and/or gleyed.
v	Very poorly drained	Water is removed from the soil so slowly that the water table remains at or near the surface for most of the time the soil is not frozen. Groundwater flow and subsurface flow are the major water sources. Precipitation is less important, except where there is a perched water table with precipitation exceeding evapotranspiration. Typically associated with wetlands. For organic wetlands, also evaluate the soil moisture subclass, and when entering on the form, separate from drainage by a slash. For example, v/ac.

Soil moisture subclasses (applied to organic soil order only) indicate the length of time the soil is saturated (Table 2.17). Record the subclass code in the "drainage" information field.

TABLE 2.17 Soil moisture subclasses and codes

Code	Moisture subclass	Description	Saturation period (mo.)	Moist period (mo.)
aq	Aqueous	Free surface water	11.5–12	< 0.5
pa	Peraquic	Soil saturated for very long periods	> 10	< 2
ac	Aquic	Soil saturated for moderately long periods	4–10	2–8
sa	Subaquic	Soil saturated for short periods	< 4	8–11.5
ph	Perhumid	No significant water deficits in growing season	< 2	8–11.5
hu	Humid	Very slight deficits in growing season	< 0.5	> 11.5

15. Flooding Regime

Flooding is defined as immersion of substrate by water (i.e., saturated peats not covered by surface water are *not* considered flooded). Flooding regimes may be indicated by one- or two-letter codes as appropriate for yearly frequency and seasonal duration (Table 2.18 and 2.19). A range of flooding regimes may also be entered (e.g., OB = occasional brief flooding and FT–AM = frequent temporary flooding to annual moderate flooding).

TABLE 2.18 Codes for frequency of flooding

Code	Description
A	Annual flood (at least once per year)
F	Frequent flooding (every 2–5 years)
O	Occasional flooding (> 5-year interval between flooding)
R	Rare flood (only during extreme events)
X	Never flooded

TABLE 2.19 Codes for duration and timing of flooding

Code	Description
W	Winter flooding
P	Permanent flooding during growing season
E	Extended flooding (exposed < 1 month during last part of growing season)
M	Moderate flooding (flooded for 1–3 months; exposed substrate for prolonged periods of the growing season)
T	Temporary flooding (7–30 days during the growing season)
B	Brief flooding (< 7 days during the growing season)
D	Diurnal flooding

Organic Horizons and Layers

The soil horizon and layer definitions and methods for field description that follow are taken or modified from Soil Classification Working Group (1998), Green et al. (1993), and Luttmerding et al. (1990).

16. Horizon/Layer

Record the organic horizon or layer designation. Two groups of master organic horizons are recognized: L, F, H ("upland") horizons, and O ("wetland") horizons. All contain > 17% organic C by mass. These two groups are differentiated primarily by the features outlined in Table 2.20.

TABLE 2.20 Guidelines for differentiating between upland and wetland organic horizons

Property	L, F, and H horizons	O horizons
Physiography	Sloping to level	Depression to gently sloping
Soil drainage	Very rapid to imperfect	Poor to very poor

TABLE 2.20 Guidelines for differentiating between upland and wetland organic horizons (continued)

Property	L, F, and H horizons	O horizons
Water table	Absent in organic horizons (may fluctuate in response to water input)	At or near ground surface for significant duration during the frost-free period
Origin of materials	Organic residues from plant communities typically associated with soil moisture regimes 0–6	Organic residues from plant communities typically associated with soil moisture regimes 7–8

Codes for master organic horizons:

L An upland horizon consisting of relatively fresh organic residues that are readily identifiable as to origin.

F An upland horizon comprised of partly decomposed plant residues in which fragmented plant structures are generally recognizable as to origin.

H An upland horizon comprised of well-decomposed plant residues in which plant structures are generally not recognizable.

O A wetland organic horizon comprised of materials in varying degrees of decomposition.

Codes for subordinate organic horizons:

Ln An L horizon composed of newly accreted and essentially unfragmented plant residues.

Lv An L horizon exhibiting initial decay and strong discoloration.

Fm An F horizon in which plant residues are aggregated in a matted structure, with a tenacious consistence. Fungal mycelia are clearly a predominant biotic component; some faunal droppings may be present.

Fz An F horizon in which plant residues are weakly aggregated with a loose or friable consistence. Faunal droppings are typically numerous and easily observed under magnification with a hand lens or binocular microscope; fungal mycelia may be present.

Fa An F horizon in which plant residues are aggregated into a weak to moderate, non-compact matted structure. This is an intergrade between the Fm and Fz horizons, and as such, reflects properties of both, but neither fungal mycelia or faunal droppings predominates.

Hh An H horizon dominated by fine substances with very few, if any, recognizable plant residues.

Hz An H horizon dominated by fine substances with very few, if any, recognizable plant residues; faunal droppings constitute most of the fabric.

Hr An H horizon dominated by fine substances, but that also contains recognizable plant residues, usually from fine roots, wood, or bark;

typically dark reddish-brown hues, around 2.5YR.

Of An O horizon comprised largely of poorly decomposed plant residues that are readily identifiable as to origin. It has 40% or more rubbed fibre (i.e., fibre that remains after rubbing a sample about 10 times between thumb and forefinger). These materials are classified in the von Post scale of decomposition (defined below, in Item 18, "Fabric") as class 1 to class 4.

Om An O horizon comprised of partly decomposed plant residues which are at a stage of decomposition intermediate between Of and Oh horizons. Rubbed fibre usually ranges between 10 and 40% by volume. These materials are classified in the von Post scale of decomposition as class 5 or 6.

Oh An O horizon of well-decomposed plant residues that for the most part have been transformed into humic materials. The rubbed fibre content is less than 10% by volume. These materials are usually classified in the von Post scale of decomposition as class 7 or higher, and very rarely as class 6.

Oco Coprogenous earth, deposited or modified by aquatic organisms.

Lowercase modifiers:
The following lowercase modifiers may be applied to any organic horizon without restriction.

i An organic horizon that contains intermixed mineral particles finer than 2 mm, with 17–35% organic C by mass. This intermixing of mineral particles with organic materials may result from several different processes (e.g., colluvial, eolian, alluvial, cryoturbation, silvoturbation, and zooturbation).

p, **u**, **y** May also be used with organic horizons, and are defined under "Mineral lowercase modifiers" in Item 24.

w An organic horizon that contains significant amounts (> 35% of the volume of solids) of coarse woody debris in various stages of decomposition.

Codes for organic layers:

S	A distinct ground surface layer of living materials such as bryophytes or "soil crusts."
Limno	A layer or layers 5 cm or more thick of sedimentary peat, diatomaceous earth, or marl.
Cumulo	A 5–30 cm thick layer or layers of mineral material in Organic soils.
Terric	An unconsolidated mineral substratum not underlain by organic matter, or one continuous unconsolidated mineral layer more than 30 cm thick in the middle or bottom tiers underlain by organic matter within a depth of 160 cm.
Lithic	Bedrock occurring within 10–160 cm in Organic soils.
Hydric	A layer of water that extends from a depth of not less than 40 cm from the organic surface to a depth of more than 160 cm.

Tiers:
Tiers are arbitrary depth intervals used in *classifying* wetland Organic soils, and consist of the surface (0–40 cm), middle (40–120 cm) and bottom tiers (120–160 cm). They are not recorded.

17. Depth

Record the average depths (in centimetres) of the upper and lower boundaries of the horizon being described. The depth of organic horizons for mineral soils are measured upward from the mineral horizon interface and recorded with the upper boundary height first (e.g., L 12–9, Fm 9–2, and Hh 2–0). In soils of the Organic soil Order, organic horizons are measured downward from the ground surface, or uppermost O horizon (e.g., S 4–0, Of 0–35, and Om 35–110).

18. Fabric

Describe the structure and consistence of the upland organic horizons and record the von Post classes for wetland horizons. Structure is important in distinguishing between Fm, Fz, and Fa horizons, and the von Post scale of decomposition helps to distinguish the Of, Om, and Oh horizons.

Structure:
Describe structure according to the *degree* and *kind* of the macromorphological aggregation of the material within a horizon. Record the structure "degree" code (Table 2.21) in the first column and the "kind" code (Table 2.22) in the second column. See diagrammatic representation in Appendix 2.2.

TABLE 2.21 Degree of aggregation codes

Code	Name	Description
W	Weak	Disaggregated materials are dominant; < 20% distinctly aggregated
M	Moderate	Some disaggregated materials are found; 20–60% distinctly aggregated
S	Strong	Aggregated materials are dominant; most material conforms to the same arrangement; > 60% distinctly aggregated

TABLE 2.22 Kind of aggregation codes

Code	Name	Description
SP	Single particle	An incoherent mass of individual particles with no aggregation
BK	Blocky	Faces rectangular and flattened; vertices angular
GR	Granular	Spheroidal and characterized by rounded or subrounded vertices
NM	Non-compact matted	Materials arranged along horizontal planes with no compaction
CM	Compact matted	Materials arranged along horizontal planes with evident compaction
ER	Erect	Materials arranged vertically
RC	Recumbent	Materials arranged in recumbent (reclining) position
MA	Massive	A coherent mass showing no evidence of aggregation

von Post scale of decomposition:
Squeeze a sample of the O horizon and observe the colour of the solution that is squeezed out between the fingers, the nature of the fibre, and the proportion of the original sample that remains in the hand. Record the class (Table 2.23).

TABLE 2.23 von Post scale of decomposition classes

Code/Class	Description
1	Undecomposed; plant structure unaltered; yields only clear water coloured light yellow brown.
2	Almost undecomposed; plant structure distinct; yields only clear water coloured light yellow brown.
3	Very weakly decomposed; plant structure distinct; yields distinctly turbid brown water, no peat substance passes between the fingers, residue not mushy.
4	Weakly decomposed; plant structure distinct; yields strongly turbid water, no peat substance escapes between the fingers, residue rather mushy.
5	Moderately decomposed; plant structure evident, but becoming indistinct; yields much turbid brown water, some peat escapes between the fingers, residue very mushy.
6	Strongly decomposed; plant structure somewhat indistinct, but more evident in the squeezed residue than in the undisturbed peat; about one-third of the peat escapes between the fingers, residue strongly mushy.
7	Strongly decomposed; plant structure indistinct, but recognizable; about one-half of the peat escapes between the fingers.
8	Very strongly decomposed; plant structure very indistinct; about two-thirds of the peat escapes between the fingers, residue almost entirely resistant remnants such as root fibres and wood.
9	Almost completely decomposed; plant structure almost unrecognizable; nearly all the peat escapes between the fingers.
10	Completely decomposed; plant structure unrecognizable; all the peat escapes between the fingers.

19. Mycelial Abundance

In most cases, fungal presence is indicated by masses of hyphae called mycelia. While individual hyphae are generally too small to be seen, the mycelial mass is usually visible. Determining mycelial abundance helps to distinguish the Fm, Fz, and Fa horizons, and therefore the humus form classification. Describe fungal mycelia by noting their abundance class as indicated in Table 2.24.

TABLE 2.24 Mycelial abundance classes and codes

Code	Name	Description
X	None	Fungal mycelia are not visible
F	Few	Fungal mycelia are occasionally present, but are scattered and not easily observed
C	Common	Fungal mycelia are commonly observed
A	Abundant	Fungal mycelia are observed continuously throughout the horizon, often "matting" materials together and creating a "felty" tactility

20. Fecal Abundance

The presence of soil fauna may be observed directly, or indirectly by the presence of fecal droppings or casts. Determining fecal abundance helps to distinguish the Fm, Fz, and Fa horizons, and therefore the humus form classification. Describe the presence of soil fauna by noting their abundance class as indicated in Table 2.25.

TABLE 2.25 Fecal abundance classes and codes

Code	Name	Description
X	None	No feces or fauna observed
F	Few	Fecal droppings or fauna occasionally observed, but scattered
C	Common	Droppings or fauna commonly observed
A	Abundant	Droppings or fauna frequently observed (droppings in relatively large numbers throughout the horizon)

21. Roots

Since root distribution in organic horizons differs substantially from that in mineral soils, the abundance and size classes and the reference unit areas are somewhat different from those used for mineral horizons (Table 2.26). Record the most abundant size first; secondary roots can be recorded by using a slash (/) in the columns as shown below:

Example: Abundant fine and plentiful medium roots.

ROOTS	
AB.	SIZE
A/P	F/M

TABLE 2.26 Root abundance and size classes and codes

Size class	v. fine	fine	medium	coarse	very coarse
Code	**V**	**F**	**M**	**C**	**K**
Size (mm)	< 1	1–2	3–5	6–15	> 15

Abundance code and class	**Reference area**				
	25 cm²		**100 cm²**		
X None	0	0	0	0	0
F Few	< 10[a]	< 10	1	1	1
P Plentiful	10–50	10–50	2–10	2–5	2–5
A Abundant	> 50	> 50	> 10	> 5	> 5

[a] Values observed in reference area represent number of roots of size class

22. pH

Record pH, noting the method of measurement in the column header (e.g., pH/3 for Hellige-Truog) (Table 2.27), and the determined values for each horizon to one decimal place.

TABLE 2.27 Codes for methods of pH measurement

Code	Method	Code	Method
1	Bromothymol blue	**6**	pH meter (0.1 M $CaCl_2$)
2	Cresol red	**7**	Phenol red
3	Hellige-Truog	**8**	Soiltex
4	Lamotte-Morgan	**9**	Thymol blue
5	pH meter (H_2O)	**10**	pHydrion
5a	pH meter for ground water sample	**11**	Litmus paper

23. Comments Section

Record any observations or measurements that are unique, unconforming, or could be of particular significance to the study, classification, or management interpretations. Examples include: consistence, character, faunal species, colour of mycelium, percentage of decaying wood, presence of charcoal, and disturbance history. When coding a property, be sure to note the property being described.

Consistence:
This describes the nature and strength of forces holding materials together. It is determined by the kind of deformation or rupture that occurs when pressure is applied and then released. Use the codes in Table 2.28 to describe consistency.

TABLE 2.28 Consistence classes and codes

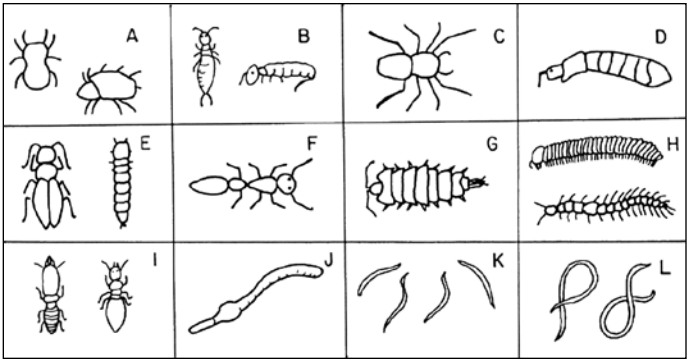
Code	Name	Description
LO	Loose	Material has no consistence
FR	Friable	Material crumbles easily under gentle pressure
FM	Firm	Material can be crushed under moderate pressure; resistance is noticeable
PL	Pliable	Material is soft and plastic
RE	Resilient	Material is springy or elastic; assumes its original shape after pressure is released
TE	Tenacious	Material is cohesive and not easily pulled apart

Character:
This describes tactile qualities, particulate shapes, and other noteworthy qualities of materials in organic horizons. Determining the character requires a qualitative examination of the fabric. Use the codes in Table 2.29 to describe character.

TABLE 2.29 Character classes and codes

Code	Name	Description
MS	Mushy	Soft and spongy tactility; materials wet or saturated
MK	Mucky	Smooth and sticky tactility; materials usually wet; silt- and clay-sized mineral particles usually present
GR	Greasy	Smooth and greasy tactility; materials easily workable when moist; fine mineral particles are usually absent
GT	Gritty	Rough tactility produced by mineral granules or coarse fragments
LF	Leafy	Tactility of materials produced by deciduous foliage showing a shingle-like layering (banded structure)
GA	Grassy	Tactility of materials produced by graminoid remains
MO	Mossy	Tactility produced by bryophytes with more or less preserved vegetative structures
AC	Acerose	Tactility produced by particles having a tip, such as the needles of conifers
FE	Felty	Tactility produced by abundant fungal mycelia
FI	Fibrous	Tactility produced by an abundance of fibrous plant residues which do not break down when rubbed between fingers (i.e., fine roots)
LG	Ligneous	Tactility produced by coniferous or deciduous wood fibres
CR	Crusty	Hard and brittle tactility of dry or desiccated materials

Fauna:
When describing soil fauna, use the name (Figure 2.3), e.g., few earthworms, several nematodes.



Label	Fauna	Label	Fauna
A	Mites (Acarina)	**G**	Woodlice (Isopoda)
B	Springtails (Collembola)	**H**	Centipedes and millipedes (Myriapoda)
C	Spiders (Araneida)	**I**	Termites (Isoptera)
D	Fly larvae (Diptera)	**J**	Earthworms (Lumbricida)
E	Beetles and larvae (Coleoptera)	**K**	Potworms (Enchytraeida)
F	Ants (Hymenoptera)	**L**	Nematodes (Nematoda)

FIGURE 2.3 Major kinds of soil fauna.

Mineral Horizons/Layers

The soil horizon and layer definitions and methods for field description that follow are taken or modified from Agriculture Canada Expert Committee on Soil Survey (1997), Green et al. (1993), and Luttmerding et al. (1990).

24. Horizon/Layer

Record the mineral horizon or layer designation followed by lowercase modifiers, e.g., Btg.

Codes for major horizons:

A Mineral horizon, containing < 17% organic C by mass, that has formed at or near the soil surface in the zone of leaching or eluviation of organic materials in solution or suspension, or of maximum *in situ* accumulation of organic matter, or both.

B Mineral horizon characterized by enrichment in organic matter, sequioxides, or clay; or by the development of soil structure; or by a change of colour denoting hydrolysis, reduction, or oxidation.

C Mineral horizon comparatively unaffected by the pedogenic processes operative in the A and B horizons, except the process of gleying (Cg), and the accumulation of calcium and magnesium carbonates (Cca) and more soluble salts (Cs, Csa).

Codes for layers:

R Consolidated bedrock layer which is too hard to break with the hands.

W Layer of water in Gleysolic, Organic, or Cryosolic soils.

Lowercase modifiers:

b Buried soil horizon.

c Irreversibly cemented horizon (ortstein, placic, duric, and $CaCO_3$ cemented layers are examples).

ca Horizon > 10 cm thick of secondary carbonate enrichment in which the concentration of lime exceeds that in the unenriched parent material.

cc Irreversibly cemented concretions.

e Horizon characterized by the eluviation of clay, Fe, Al, or organic matter alone or in combination.

f Horizon enriched with amorphous material, principally Al and Fe combined with organic matter. It must have a hue of 7.5YR or redder, or its hue must be 10YR near the upper boundary and becomes yellower with depth. When moist

the chroma is higher than three or the value is three or less. It is used primarily with the Bf, Bhf, Bfg, and Bgf codes. The following f horizons are differentiated on the basis of the organic C content:

Bf 0.5–5% organic C

Bhf >5% organic C

g Horizon characterized by gray colours, or prominent mottling, or both, which indicates of permanent or periodic intense reduction. Chromas of the matrix are generally one or less. It is used with the Aeg, Bg, Bfg, Bgf, Bhfg, Btg, Cg, Ckg codes, and others. When used with the Ae, Bf, Bhf, and Bt codes, the limits set for the other modifiers must be met. The Bgf horizons are usually prominently mottled; more than half of the soil material occurs as mottles of high chroma. The Bgf horizons occur in Fera Gleysols and Fera Humic Gleysols and possibly below the Bfg of gleyed Podzols.

h Horizon enriched with organic matter. It is used with the Ah, Ahe, Bh, and Bhf codes.

Ah - An A horizon enriched with humified organic matter; at least one colour value unit lower that the underlying horizon, or 0.5% more organic C than the C horizon or both.

Ahe - An Ah horizon that has undergone eluviation as evidenced by streaks and splotches of different shades of gray, and often by plated structure.

Bh - Contains > 1% organic C with less than 0.3% pyrophosphate-extractable Fe [Fe(p)] and a ratio of C : Fe(p) of 20 or more (*very* rare in British Columbia).

Bhf - Defined under f above.

j Used with e, f, g, n, and t to denote an expression of, but failure to meet, the specified limits of the letter code it modifies. It is placed to the right of the letter it modifies.

k Denotes the presence of carbonate as indicated by visible effervescence when a dilute HCl solution is added.

m Horizon slightly altered by hydrolysis, oxidation, or solution, or all three to give a change in colour or structure, or both. It is used with the Bm, Bmgj, Bmk, and Bms codes.

It has:

1. Evidence of one of or more of the following:
   - higher chromas and redder hues than the underlying horizons;
   - enrichment or complete removal of carbonates either as Bmk or Bm; and/or
   - change in structure from that of the original material.

2. Illuviation too slight to meet requirements of a Bt or podzolic B.
3. No cementation or induration and lacks a brittle consistence when moist.

n Horizon with distinctive prismatic or columnar structure, dark coatings on ped surfaces, and hard to very hard consistence when dry; the exchangeable Ca to exchangeable Na is 10 or less. It is used with Bn or Bnt codes.

p Horizon disturbed by human activities, such as cultivation, logging, and habitation.

s Horizon with salts, including gypsum, which may be detected as crystal or veins, or as surface crusts of salt crystals. It is used with any combination of horizon codes.

sa Horizon > 10 cm thick with secondary enrichment of salts more soluble than Ca and Mg carbonates; the concentration of salts exceeds that in the unenriched parent material.

t An illuvial horizon enriched with silicate clay. It is used with the Bt, Btg, and Bnt codes and may be modified by j.

To use Bt:

- The horizon must be at least 5 cm thick.
- If any part of an the eluvial horizon has < 15% total clay in the fine fraction (< 2 mm), the Bt horizon must contain at least 3% more clay and if > 40% total clay, then it must contain at least 8% more clay.
- If the eluvial horizon has > 15% and < 40% clay in the fine fraction, then the ratio of the clay in the Bt to that of the eluvial horizon must be 1.2 or more (e.g., Ae 25 % clay; Bt at least 30% clay).
- In massive soils, there should be oriented clay in pores and as bridges between sand grains.
- If peds are present, clay films (skins) should be visible on ped surfaces and in pores.

u Horizon that is markedly disrupted by physical (e.g., blowdown of trees, mass movement, etc.) or faunal processes (e.g., burrowing animals), but not from cryoturbation.

x Horizon of fragipan character; loamy subsurface horizon of high bulk density and very low organic matter. When dry, it is hard and seems to be cemented; when moist is has moderate to weak brittleness. Air-dried clods slake (crumble) in water.

y Horizon affected by cryoturbation. It is used with any combination of horizon codes.

z A frozen layer, it may be used with any horizon or layer code.

Mineral diagnostic horizons:

Chernozemic A

- At least 10 cm thick;
- Colour value darker than 5.5 dry and 3.5 moist, chroma is lower than 3.5 moist;
- Organic C content 1–17% and C:N ratio <17;
- Structure, when dry, is neither massive and hard, nor single grained; and
- Mean annual soil temperature of 0° C or higher and a soil moisture regime subclass drier than humid.

Duric horizon
A strongly cemented horizon that does not satisfy the criteria of a podzolic B horizon. Usually has an abrupt upper boundary and a diffuse lower boundary. Air-dried clods do not hydrate in water, and moist clods at least 3 cm thick usually can not be broken in the hands.

Fragipan horizon
See definition of "x" above.

Ortstein horizon
A strongly cemented Bh, Bhf, of Bf horizon at least 3 cm thick which occurs in more than one-third of the exposed pedon. Generally reddish brown to very dark reddish brown.

Placic horizon
A thin layer (commonly 5 mm or less thick) or a series of thin layers that are irregular or involuted, hard, impervious, often vitreous, and dark reddish brown to black.

Podzolic B horizon (field criteria only)

- At least 10 cm thick;
- Moist crushed color: hue is 7.5YR or redder or 10YR near the upper boundary and becomes yellower with depth. The chroma is higher than 3 or the value is 3 or less;
- Accumulation of amorphous material is indicated by brown to black coatings on some mineral grains or brown to black microaggregates. Silty feel when the material is rubbed wet, unless cemented; and
- Texture coarser than clay.

Solonetzic B horizon
The term includes both Bn and Bnt horizons.

Lithic layer
Bedrock (R) below a depth of 10 cm. The upper surface of a lithic layer is a lithic contact.

25. Depth

Record the average depths (in centimetres) of the upper and lower boundaries of the soil horizon being described, e.g., Ah 0–5, Bm 5–20. The top of the uppermost mineral horizon is considered as zero depth.

26. Colour

Soil colour is determined by comparison with Munsell Colour Charts . The notation for a specific colour should be in the order of hue, value/chroma. Intermediate hues, values, and chromas may be expressed with the use of decimals.

ASP - Colour Aspect

The colour of a soil varies with its moisture content and physical state. Record the aspect of the Munsell colour notation using the codes in Table 2.30.

TABLE 2.30 Colour aspects and codes for mineral soils

Code	Name	Description
1	Matrix moist	Matrix is the main soil constituent or material that encloses other soil features, for example, peds. This colour aspect is reserved for structureless soils or weakly structured soils whose peds crumble upon handling.
2	Matrix dry	
3	Exped moist	Colour of ped surfaces in soils with moderately durable peds which may be broken open and examined.
4	Exped dry	
5	Inped moist	Dominant colour of ped interiors in soils with moderately durable peds that may be broken open and examined.
6	Inped dry	
7	Crushed moist	Soil material is crushed and mixed. Surface of the sample is smoothed to reduce irregularities that affect colour.
8	Crush dry	

27. Texture

Soil texture is defined by the size distribution of primary mineral particles (2 mm diameter or less). The textural classes and codes are determined from the soil texture triangle by estimating the percentage of clay (less than 0.002 mm diameter) and sand (0.05 to < 2.0 mm diameter)(Figure 2.4). The Keys and Codes (section 9) includes a key to soil texture and letter-code descriptions (9.19).

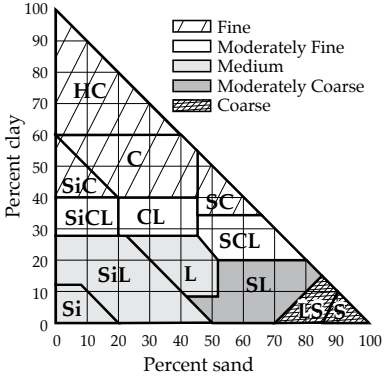


FIGURE 2.4 Soil texture triangle.

28. Percent Coarse Fragments

Estimate the percent coarse fragment (> 2 mm diameter) volume in each size class and record the total percent. Coarse fragments should fit through a sieve of the diameter limit specified below. A coarse fragment has a long axis (A); the diameter should be measured at the widest point when looking down the A-axis (B-axis). (Figure 2.5) Describe the coarse fragment shape using the type codes in Table 2.31.

TABLE 2.31 Size classes and type codes for coarse fragments

	Shape type: R, S, A[a]	**Shape type: T**
Size Classes	**Diameter (cm)**	**Length (cm)**
G - Gravel	< 7.5	< 15
C - Cobbles	7.5–25	15–38
S - Stones and boulders	>25	> 38

[a] type codes: **R** = rounded; **S** = subrounded and subangular; **A** = angular; **T** = thin, flat.

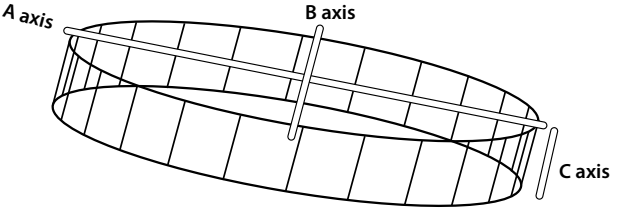


FIGURE 2.5 Coarse fragments should be measured along the B axis for determining size class.

29. Roots

Describe roots by noting their abundance and size (Table 2.32). Record the most abundant size first; secondary roots can be recorded by using a slash (/) in the columns (see example in Item 21).

TABLE 2.32 Root abundance and size classes and codes

Size class	Very fine	Fine	Medium	Coarse
Code	**V**	**F**	**M**	**C**
Size (mm)	< 1	1 to 2	3 to 5	> 5
Abundance code and class				
X None	0	0	0	0
F Few	< 10[a]	< 10	1	1
P Plentiful	10–100	10–100	2–10	2–5
A Abundant	> 100	> 100	> 10	> 5

[a] Values represent number of roots of size class observed in reference area of 100 cm^2.

30. Structure

Record the kind and class of structure (see Table 2.33 below and Figure 2.5). When more than one kind of primary structure is present, record the dominant under structure, and the subordinate in comments.

TABLE 2.33 Codes for kind and class of soil particle structure

Kind	Class		Size (mm)[a]
ABK: Angular blocky; peds bounded by flattened, rectangular faces intersecting at relatively sharp angles	**VF**	very fine angular blocky	< 5
	F	fine angular blocky	5–10
	M	medium angular blocky	10–20
	C	coarse angular blocky	20–50
	VC	very coarse angular blocky	> 50
SBK: Subangular blocky; peds bounded by slightly rounded, subrectangular faces with vertices[b] of their intersections mostly subrounded	**VF**	very fine subangular blocky	< 5
	F	fine subangular blocky	5–10
	M	medium subangular blocky	10–20
	C	coarse subangular blocky	20–50
	VC	very coarse subangular blocky	> 50
GR: Granular; spheroidal peds bounded by curved or very irregular faces that do not adjoin those of adjacent peds	**VF**	very fine granular	< 1
	F	fine granular	1–2
	M	medium granular	2–5
	C	coarse granular	5–10
	VC	very coarse granular	> 10
PL: Platy; peds flat or platelike; horizontal planes more or less well developed	**VF**	very fine platy	< 1
	F	fine platy	1–2
	M	medium platy	2–5
	C	coarse platy	5–10
	VC	very coarse platy	> 10

TABLE 2.33 Codes for kind and class of soil particle structure (continued)

Kind	Class		Size (mm)[a]
PR: Prismatic; vertical faces of peds well defined and vertices[b] angular (edges sharp); prism tops essentially flat	**VF**	very fine prismatic	< 10
	F	fine prismatic	10–20
	M	medium prismatic	20–50
	C	coarse prismatic	50–100
	VC	very coarse prismatic	> 100
COL: Columnar; vertical edges near top of columns not sharp (vertices[b] subrounded); column tops flat, rounded, or irregular	**VF**	very fine columnar	< 10
	F	fine columnar	10–20
	M	medium columnar	20–50
	C	coarse columnar	50–100
	VC	very coarse columnar	> 100
SGR: single grained	Loose, incoherent mass of individual primary particles, as in sands		
MA: Massive	Amorphous; a coherent mass showing no evidence of any distinct arrangement of soil particles; separates into clusters of particles, not peds		
CDY:	Cloddy; not a structure, used to indicate the condition of some ploughed surfaces.		

[a] The size limits refer to measurements in the smallest dimension of platy, prismatic, and columnar peds, and to the largest of the nearly equal dimensions of blocky and granular peds.

[b] Definition of vertex (plural, vertices): the intersection of two planes of a geometrical figure.

Grade The degree of distinctness of aggregation of soil particles. If grade of structure is described, record with class code separated by a slash (e.g., S/VC = strong/very coarse).

W = Weak
WM = Weak to moderate
M = Moderate
MS = Moderate to strong
S = Strong

31. pH

Record pH by noting the method of measurement (see Table 2.26 under Item 22) and the determined values to one decimal place.

32. Comments

Record any observations or measurements that are unique, unconforming, or could be of particular significance to the study, classification, or management interpretations. Examples include: colour and description of mottles (see colour section), description of clay films, and porosity.

Mottling:

Described by recording *abundance*, *size*, and *contrast* and *colour* (see Tables 2.34 and 2.35). Use Munsell Colour Charts, defaulting to aspect 7, crushed moist, unless otherwise noted. For example, *FMD 7.5YR mottles* = few, medium, distinct, strong brown (crushed moist) mottles.

TABLE 2.34 Abundance and size codes for mottles

Abundance			Size		
Code	**Class**	**% of exposed surface**	**Code**	**Class**	**Diameter (mm)**
F	Few	<2	F	Fine	5
C	Common	2–20	M	Medium	5–15
M	Many	>20	C	Coarse	>15

TABLE 2.35 Contrast codes for mottles

Code	Description
F	**Faint:** Evident only on close examination. Faint mottles commonly have the same hue as the colour to which they are compared and differ by no more than 1 unit of chroma or 2 units of value. Some faint mottles of similar but low chroma and value can differ by 2.5 units of hue.
D	**Distinct:** Readily seen, but contrast only moderately with the colour to which they are compared. Distinct mottles commonly have the same hue as the colour to which they are compared, but differ by 2–4 units of chroma or 3–4 units of value; or differ from the colour to which they are compared by 2.5 units of hue, but by no more than 1 unit of chroma or 2 units of value.

TABLE 2.35. Contrast codes for mottles (continued)

Code	Description
P	**Prominent:** Contrast strongly with the colour to which they are compared. Prominent mottles are commonly the most obvious colour feature in a soil. Prominent mottles that have medium chroma and value commonly differ from the colour to which they are compared by at least 5 units of hue, if chroma and value are the same; by at least 4 units of value or chroma, if the hue is the same; or by at least 1 unit of chroma or 2 units of value, if hue differs by 2.5 units.

Clay films (skins):
Accumulations of oriented clay translocated from another part of the soil. Clay films are described by recording the *frequency* of occurrence, and estimated *thickness* (see Tables 2.36 and 2.37). Most Bt horizons will exhibit clay films and should be noted. For example, *FMTK clay films* = Few, moderately thick clay films.

TABLE 2.36 Clay film frequency classes

Code	Class	Description
X	None	No clay films present.
F	Few	Clay films cover less than 2% of the total area of the specified surface(s). Patches of film are identifiable, but their frequency is so low that the significance of their presence may be nil or doubtful.
C	Common	Clay films cover 2–20% of the total area of the specified surface(s).
M	Many	Clay films cover 20–80% of the total area of the specified surface(s). They may occur as discrete patches or as a continuous network.
CS	Continuous	Clay films cover more than 80% of the total area of the specified surface(s). Patches of these surfaces may be free of clay films, but the films are essentially continuous.

TABLE 2.37 Clay film thickness classes

Code	Class	mm	Description
TN	Thin	<0.05	Hand lens is needed for identification; visible in cross-section with 10X lens, but not to the unaided eye. If present, fine sand grains protrude through the film or are only thinly coated and are readily apparent.
MTK	Moderately thick	0.05–0.5	Clay films are visible in cross-section to the unaided eye. Fine sand grains are enveloped by the film or their outlines are indistinct. Film surfaces are relatively smooth.
TK	Thick	0.5–1.0	Clay films and their broken edges are readily visible without magnification. Film surfaces are smooth.
VTK	Very thick	>1.0	Clay films are a striking feature of the morphology.

Effervescence:
The bubbling, hissing, or foaming that occurs when a 10% HCl solution is added to a sample of soil. Enter the appropriate code from Table 2.38.

TABLE 2.38 Codes to describe degree of effervescence

Code	Class	Degree of effervescence
X	None	No evidence of effervescence
VW	Very Weak	Few bubbles. (Note: ensure that the crackling sound is from reaction rather than absorption of liquid; compare with water).
W	Weak	Bubbles readily observed
M	Moderate	Bubbles form low foam
S	Strong	Bubbles form thick foam

Horizon porosity:
An estimate of total pore volume that reflects the combined effects of soil structure and density. Record porosity classes for mineral horizons as described in Table 2.39.

TABLE 2.39 Mineral horizon porosity classes

Code	Porosity class	Description
S	Slightly porous	Closely packed structureless soil material; highly compacted material.
M	Moderately porous	Horizons with weak to moderate structure and moderately close packing; closely packed soils with large, well-developed peds.
H	Highly porous	Horizons that are loosely packed, and/or very well structured with small peds.

33. Profile diagram

Sketch a cross-sectional profile diagram of the horizon boundaries, and add other significant features (relative coarse fragment distribution and size, piping, turbation, seepage, water table, lithic contact, etc.) (see example, Figure 2.6).

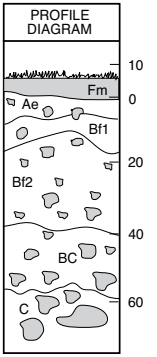


FIGURE 2.6 Example of profile diagram.

34. Notes

Use this section to summarize or describe soil features not otherwise recorded on the form or that are significant to the study, classifications, or management interpretations.

Appendix 2.1 Codes for Soil Orders, Great Groups, and Subgroups

Brunisolic Order (B)

Melanic Brunisol MB
Orthic **O.MB**
Eluviated **E.MB**
Gleyed **GL.MB**
Gleyed Eluviated **GLE.MB**

Eutric Brunisol EB
Orthic **O.EB**
Eluviated **E.EB**
Gleyed **GL.EB**
Gleyed Eluviated **GLE.EB**

Sombric Brunisol SB
Orthic **O.SB**
Eluviated **E.SB**
Duric **DU.SB**
Gleyed **GL.SB**
Gleyed Eluviated **GLE.SB**

Dystric Brunisol DYB
Orthic **O.DYB**
Eluviated **E.DYB**
Duric **DU.DYB**
Gleyed **GL.DYB**
Gleyed Eluviated **GLE.DYB**

Chernozemic Order (CH)

Brown Chernozem BC
Orthic **O.BC**
Rego **R.BC**
Calcareous **CA.BC**
Eluviated **E.BC**
Solonetzic **SZ.BC**
Vertic **V.BC**
Gleyed **GL.BC**
Gleyed Rego **GLR.BC**
Gleyed Calcareous **GLA.BC**
Gleyed Eluviated **GLE.BC**
Gleyed Solonetzic **GLSZ.BC**
Gleyed Vertic **GLV.BC**

Dark Brown Chernozem DBC
Orthic **O.DBC**
Rego **R.DBC**
Calcareous **CA.DBC**
Eluviated **E.DBC**
Solonetzic **SZ.DBC**
Gleyed **GL.DBC**
Gleyed Rego **GLR.DBC**
Gleyed Calcareous **GLCA.DBC**
Gleyed Eluviated **GLE.DBC**
Gleyed Solonetzic **GLSZ.DBC**

Black Chernozem BLC
Orthic **O.BLC**
Rego **R.BLC**
Calcareous **CA.BLC**
Eluviated **E.BLC**
Solonetzic **SZ.BLC**
Vertic **V.BLC**
Gleyed **GL.BLC**
Gleyed Rego **GLR.BLC**
Gleyed Calcareous **GLCA.BLC**
Gleyed Eluviated **GLE.BLC**
Gleyed Solonetzic **GLSZ.BLC**
Gleyed Vertic **GLV.BLC**

Dark Gray Chernozem DGC
Orthic **O.DGC**
Rego **R.DGC**
Calcareous **CA.DGC**
Solonetzic **SZ.DGC**
Vertic **V.DGC**
Gleyed **GL.DGC**
Gleyed Rego **GLR.DGC**
Gleyed Calcareous **GLCA.DGC**
Gleyed Solonetzic **GLSZ.DGC**
Gleyed Vertic **GLV.DGC**

Cryosolic Order (CY)

Turbic Cryosol TC
Orthic Eutric **OE.TC**
Orthic Dystric **OD.TC**
Brunisolic Eutric **BRE.TC**
Brunisolic Dystric **BRD.TC**
Histic Eutric **HE.TC**
Histic Dystric **HD.TC**
Luvisolic **L.TC**
Regosolic **R.TC**
Gleysolic **GL.TC**

Static Cryosol SC
Orthic Eutric **OE.SC**
Orthic Dystric **OD.SC**
Brunisolic Eutric **BRE.SC**
Brunisolic Dystric **BRD.SC**
Histic Eutric **HE.SC**
Histic Dystric **HD.SC**
Luvisolic **L.SC**
Gleysolic Static Cryosol **GL.SC**
Regosolic Static Cryosol **R.SC**

Organic Cryosol OC
Fibric **FI.OC**
Mesic **ME.OC**
Humic **HU.OC**
Terric Fibric **TFI.OC**
Terric Mesic **TME.OC**
Terric Humic **THU.OC**
Glacic **GC.OC**

Gleysolic Order (G)

Luvic Gleysol LG
Solonetzic **SZ.LG**
Fragic **FR.LG**
Humic **HU.LG**
Fera **FE.LG**
Orthic **O.LG**
Vertic **V.LG**

Humic Gleysol HG
Solonetzic **SZ.HG**
Fera **FE.HG**
Orthic **O.HG**
Rego **R.HG**
Vertic **V.HG**

Gleysol G
Solonetzic **SZ.G**
Fera **FE.G**
Orthic **O.G**
Rego **R.G**
Vertic **V.G**

Luvisolic Order (L)

Gray Brown Luvisol GBL
Orthic **O.GBL**
Brunisolic **BR.GBL**
Podzolic **PZ.GBL**
Vertic **V.GBL**
Gleyed **GL.GBL**
Gleyed Brunisolic **GLBR.GBL**
Gleyed Podzolic **GLPZ.GBL**
Gleyed Vertic **GLV.GBL**

Gray Luvisol GL
Orthic **O.GL**
Dark **D.GL**
Brunisolic **BR.GL**
Podzolic **PZ.GL**
Solonetzic **SZ.GL**
Fragic **FR.GL**
Vertic **V.GL**
Gleyed **GL.GL**
Gleyed Dark **GLD.GL**
Gleyed Brunisolic **GLBR.GL**
Gleyed Podzolic **GLPZ.GL**
Gleyed Solonetzic **GLSZ.GL**
Gleyed Fragic **GLFR.GL**
Gleyed Vertic **GLV.GL**

Organic Order (O)

Fibrisol F
Typic **TY.F**
Mesic **ME.F**
Humic **HU.F**
Limnic **LM.F**
Cumulic **CU.F**
Terric **T.F**

Terric Mesic **TME.F**
Terric Humic **THU.F**
Hydric **HY.F**

Mesisol M
Typic **TY.M**
Fibric **FI.M**
Humic **HU.M**
Limnic **LM.M**
Cumulic **CU.M**
Terric **T.M.**
Terric Fibric **TFI.M**
Terric Humic **THU.M**
Hydric **HY.M**

Humisol H
Typic **TY.H**
Fibric **FI.H**
Mesic **ME.H**
Limnic **LM.H**
Cumulic **CU.H**
Terric **T.H**
Terric Fibric **TFI.H**
Terric Mesic **TME.H**
Hydric **HY.H**

Folisol FO
Hemic **HE.FO**
Humic **HU.FO**
Lignic **LI.FO**
Histic **HI.FO**

Podzolic Order (P)

Humic Podzol HP
Orthic **O.HP**
Ortstein **OT.HP**
Placic **P.HP**
Duric **DU.HP**
Fragic **FR.HP**

Ferro-Humic Podzol FHP
Orthic **O.FHP**
Ortstein **OT.FHP**
Placic **P.FHP**
Duric **DU.FHP**
Fragic **FR.FHP**
Luvisolic **LU.FHP**
Sombric **SM.FHP**
Gleyed **GL.FHP**
Gleyed Ortstein **GLOT.FHP**
Gleyed Sombric **GLSM.FHP**

Humo-Ferric Podzol HFP
Orthic **O.HFP**
Ortstein **OT.HFP**
Placic **P.HFP**
Duric **DU.HFP**
Fragic **FR.HFP**
Luvisolic **LU.HFP**
Sombric **SM.HFP**
Gleyed **GL.HFP**
GleyedOrtstein **GLOT.HFP**
Gleyed Sombric **GLSM.HFP**

Regosolic Order (R)

Regosol R
Orthic **O.R**
Cumulic **CU.R**
Gleyed **GL.R**
Gleyed Cumulic **GLCU.R**

Humic Regosol HR
Orthic **O.HR**
Cumulic **CU.HR**
Gleyed **GL.HR**
Gleyed Cumulic **GLCU.HR**

Solonetzic Order (S)

Solonetz SZ
Brown **B.SZ**
Dark Brown **DB.SZ**
Black **BL.SZ**
Alkaline **A.SZ**
Gleyed Brown **GLB.SZ**
Gleyed Dark Brown **GLDB.SZ**
Gleyed Black **GLBL.SZ**

Solodized Solonetz SS
Brown **B.SS**
Dark Brown **DB.SS**

Black **BL.SS**
Dark Gray **DG.SS**
Gray **G.SS**
Gleyed Brown **GLB.SS**
Gleyed Dark Brown **GLDB.SS**
Gleyed Black **GLBL.SS**
Gleyed Dark Gray **GLDG.SS**
Gleyed Gray **GLG.SS**

Solod SO
Brown **B.SO**
Dark Brown **DB.SO**
Black **BL.SO**
Dark Gray **DG.SO**
Gray **G.SO**
Gleyed Brown **GLB.SO**
Gleyed Dark Brown **GLDB.SO**
Gleyed Black **GLBL.SO**
Gleyed Dark Gray **GLDG.SO**
Gleyed Gray **GLG.SO**

Vertisolic (V)

Vertisol V
Orthic **O.V**
Gleyed **GL.V**
Gleysolic **GLC.V**

Humic Vertisol HV
Orthic **O.HV**
Gleyed **GL.HV**
Gleysolic **GLC.HV**

Appendix 2.2 Diagrammatic representation of soil structure

Appendix 2.2 (continued)

3 VEGETATION

Contents

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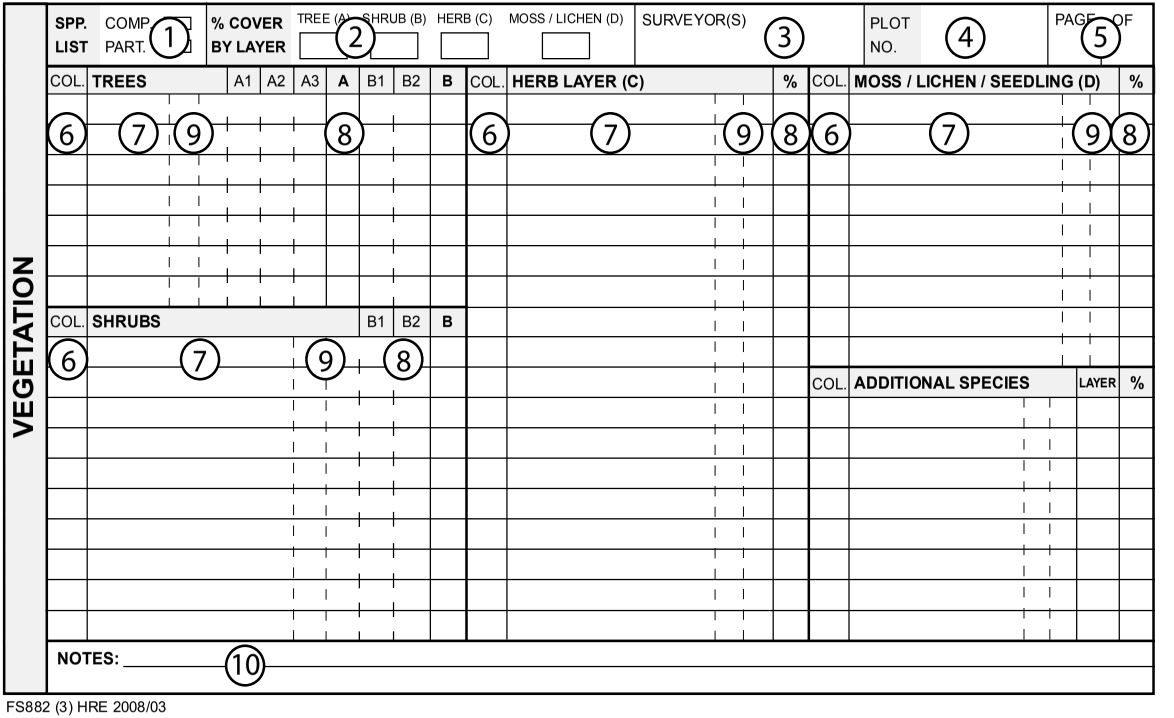

VEGETATION
SPP. LIST
COMP.
PART.
1
% COVER BY LAYER
TREE (A)
SHRUB (B)
HERB (C)
MOSS / LICHEN (D)
2
SURVEYOR(S)
3
PLOT NO.
4
PAGE OF
5
COL.
TREES
A1
A2
A3
A
B1
B2
B
6
7
9
8
COL.
HERB LAYER (C)
%
6
7
9
8
COL.
MOSS / LICHEN / SEEDLING (D)
%
6
7
9
8
COL.
SHRUBS
B1
B2
B
6
7
9
8
COL.
ADDITIONAL SPECIES
LAYER
%
NOTES:
10

Field Procedures

Getting Started

1. Locate plot boundaries.
2. Assemble description forms, collection bags, and implements (e.g., a knife, small shovel).

Record and Estimate

1. Photograph the plot, if required.
2. Enter the plot number and surveyors' names.
3. Standing at one point in the plot, list all species observed in each layer.
4. Traverse the entire plot (or one quadrant at a time) in an increasing spiral or zig-zag pattern, noting each new species.
5. Collect unknown species, recording each by a temporary name and plot collection number on the form (e.g., moss 01, hairy grass 02, herb 03, etc.). Mark sample bags and pressing sheets with plot and collection numbers.
6. When the list seems complete, begin estimating percent cover. For each layer:
   - estimate total layer cover and enter at top of form;
   - estimate individual species covers for the entire layer and sub-layers, if present (i.e., first A, then A1, A2, A3);
   - add up species covers and compare to total species cover and total layer cover; reconcile any discrepancies, remembering that overlap can occur between species and layers.
7. Check that all required fields have been completed on the form.

Guidelines for Describing Vegetation

Throughout the process of describing vegetation, observe the following guidelines.

Vegetation Layers

All vegetation is assigned to one of the following layers. Criteria for A and B layers and sub-layers are depicted in Figure 3.1.

A. The *tree layer* includes all woody plants greater than 10 m tall. Three sub-layers are recognized:

A1 **Dominant trees** - includes the dominant (tallest) trees of the main canopy, which may be veterans of one or more fires (previously classed as A0), or the tallest trees of the same age class as the main canopy; usually a minor portion of the stand composition.

A2 **Main tree canopy (codominant trees)** - the main layer of tree cover, composed of trees whose crowns form the upper layer of foliage; typically the major portion of the stand composition.

A3 **Sub-canopy trees** - includes trees greater than 10 m high that do not reach the main canopy; may form a distinct secondary canopy; often a mixture of trees of various heights younger than those in the main canopy or may be suppressed trees of the same age; includes "intermediate" and "overtopped" trees (terminology of MFR Resources Inventory Branch).

B. The *shrub layer* includes all woody plants less than 10 m tall, except low (usually < 15 cm tall) woody or trailing plants which are considered part of the herb layer (see Table 3.1). Established tree regeneration more than two years of age and less than 10 m in height is considered part of the shrub layer. Two sub-layers are recognized:

B1 **Tall shrub layer** - includes all woody plants 2–10 m tall, including shrubs and advance tree regeneration and trees in poorly growing stands where the canopy is less than 10 m high.

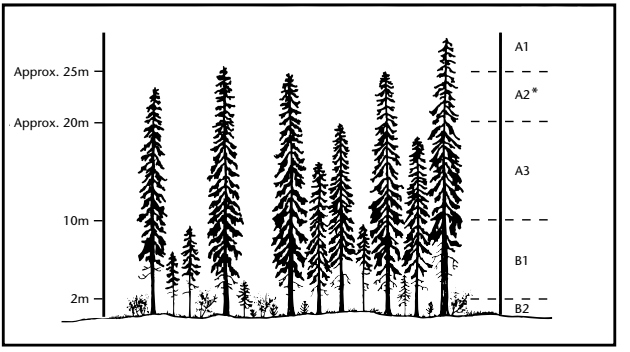
B2 **Low shrub layer** - includes all woody plants less than 2 m high, except low (< 15 cm) woody or trailing plants (see Table 3.1); includes shrubs and established tree regeneration more than two years old and dwarfed or immature specimens of species normally considered in the shrub category (e.g., young *Vaccinium membranaceum*, or dwarf alpine forms of normally taller shrubs).

C. The *herb layer* includes all herbaceous species, regardless of height, and some low woody plants less than 15 cm tall (see Table 3.1).

D. The *moss, lichen, liverwort and seedling layer* includes all bryophytes, terrestrial lichens, and liverworts, and tree seedlings less than two years old that occur on mineral soil and humus.

Dr - *Mosses, lichens, liverworts* that occur on rock.

Dw - *Mosses, lichens, liverworts* that occur on wood.



** A2 layer will be shorter than indicated in low growing stands*

FIGURE 3.1 Stratification of forest stands, shrubs, and trees.

E. The *epiphyte layer* includes all species which grow on other living plants. Enter epiphytes in the additional species block.

Species Lists

Record the species of all vegetation by layer, either by entering the names in full, or using the 4-3-1 (genus-species-subspecies or variety) code from *British Columbia Plant Species Codes and Selected Attributes* (Meidinger et al. 2009). At a minimum, record all those species growing on the dominant substrate, which will most often be organic matter but on some sites may be rock, decaying wood, or mineral soil.

Certain projects may require only a listing of indicator plants or dominant species growing on the main substrate. In such cases, it is important to indicate that only a partial listing has been made, by checking the appropriate box (PART.) at the top of the form.

Unknown Species

Collect specimens of unknown species for verification, numbering them sequentially within each plot and recording the plot number, temporary name, and collection number on collection bags and pressing sheets. Mark the collection column of the

TABLE 3.1 List of low woody species and species of uncertain life form assigned to the herb layer

Scientific Name	Scientific Name
*Andromeda polifolia**	*Linnaea borealis**
Anemone multifida	*Lithospermum incisum*
Apocynum androsaemifolium	*Lithospermum ruderale*
Apocynum cannabinum	*Loiseleuria procumbens**
Apocynum medium	*Luetkea pectinata**
Apocynum sibiricum	*Orthilia secunda*
*Arctostaphylos uva-ursi**	*Oxycoccus macrocarpus**
*Arctous alpinus**	*Oxycoccus oxycoccos**
*Arctous ruber**	*Penstemon davidsonii**
Aruncus dioicus	*Penstemon ellipticus**
Asclepias ovalifolia	*Phlox caespitosa*
Asclepias speciosa	*Phyllodoce empetriformis**
*Cassiope lycopodioides**	*Phyllodoce glanduliflora**
*Cassiope mertensiana**	*Polygonum cuspidatum*
*Cassiope tetragona**	*Polygonum paronychia*
Chamaerhodos erecta	*Polygonum polystachyum*
*Chimaphila menziesii**	*Polygonum sachalinense*
*Chimaphila umbellata**	*Rhododendron lapponicum**
Cornus canadensis	*Rubus arcticus*
Cornus suecica	*Rubus chamaemorus*
Draba spp.	*Rubus lasiococcus*
*Dryas drummondii**	*Rubus nivalis**
*Dryas integrifolia**	*Rubus pedatus*
*Dryas octopetala**	*Rubus pubescens*
*Empetrum nigrum**	*Rubus ursinus**
Eriogonum androsaceum	*Salix arctica**
Eriogonum flavum	*Salix cascadensis**
Eriogonum heracleoides	*Salix nivalis**
Eriogonum niveum	*Salix petrophila**
Eriogonum ovalifolium	*Salix polaris**
Eriogonum pauciflorum	*Salix reticulata**
Eriogonum umbellatum	*Salix stolonifera**
Frageria chiloensis	*Saxifraga bronchialis*
Fragaria vesca	*Saxifraga cespitosa*
Fragaria virginiana	*Saxifraga flagellaris*
Galium boreale	*Saxifraga oppositifolia*
*Gaultheria hispidula**	*Saxifraga tricuspidata*
*Gaultheria humifusa**	*Sibbaldia procumbens*
*Gaultheria ovatifolia**	*Vaccinium caespitosum**
Geocaulon lividum	*Vaccinium myrtillus**
*Harrimanella stelleriana**	*Vaccinium scoparium**
*Kalmia microphylla**	*Vaccinium vitis-idaea**

* low woody species

Vegetation Form for collected species. Record percent cover for unknowns on the form using the temporary name and collection number in lieu of species name (e.g., moss 03). These procedures are extremely important if several persons are collecting data, or if a significant time lag occurs between field collection and office verification and coding.

Plants Growing on Subdominant Substrates

Where the objectives of a study or the features of a particular site warrant identifying plants growing on non-dominant substrates, list species and covers under "Additional Species" on the form. Identify the layer to which the plant belongs (A–E) and the type of substrate using the codes in Table 3.2. Label the top of the blank column used to record the type of substrate as **"SS"** (subdominant substrate). Note that for Moss Layer species, covers should be recorded using Dw (for wood) and Dr (for rock).

TABLE 3.2 Codes for subdominant substrates for vascular plants

Code	Description
A	Aquatic; where water is the subdominant substrate
L	Cobbles, stones, or bedrock outcrops (epiliths)
O	Organic matter (e.g., plants growing on patches of organic matter on a talus slope where the dominant substrate is rock)
S	Bare soil (episols)
X	Dead wood (epixyles)

Estimating Percent Cover

In most surveys, only those species growing on the dominant substrate are included in estimates. Percent cover is estimated as the percentage of the ground surface covered when the crowns are projected vertically. Follow the outside perimeter of the projected crown. For the tree layer, distinct holes in the canopy should be subtracted from the estimate. For other layers, small gaps that are not fully covered can be ignored.

- Viewing the layer obliquely, rather than vertically, can result in an over-estimation.
- Avoid biasing estimates because of crown density.
- For species with high cover values, mentally move the plants to a corner of the plot to estimate if they represent one-quarter, one-third, or one-half, or more of the plot.
- For species that almost cover the plot, mentally move them together and estimate how much of the area is not covered by the plants.

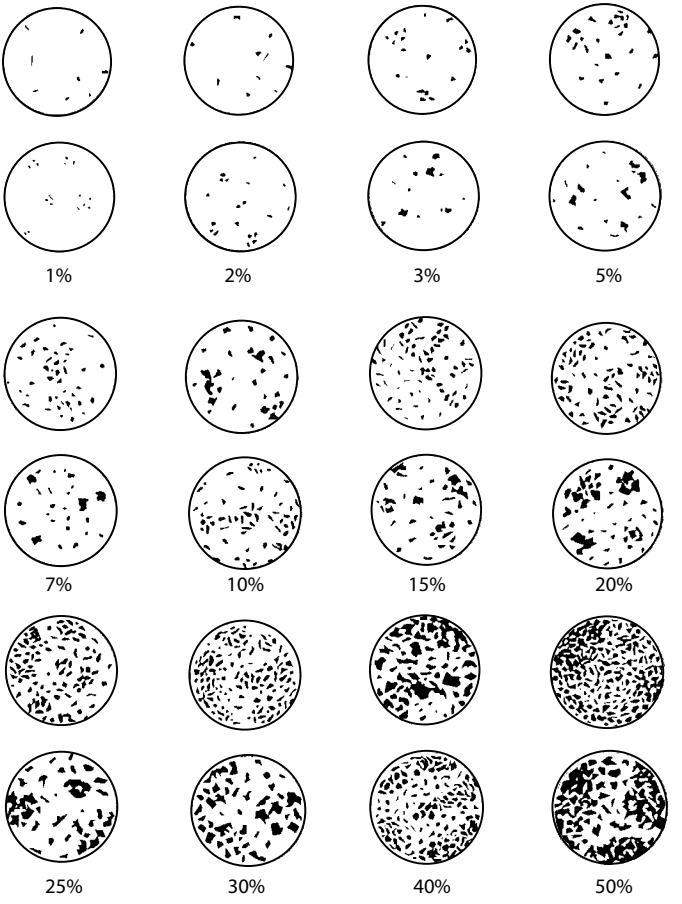


FIGURE 3.2 Comparison charts for visual estimation of foliage cover.

- For species with low cover, try making estimates for subsections in each quarter of the plot.
- Equating percent cover with equivalent dimensions relative to plot area can be very helpful (Table 3.3). For several small scattered areas of coverage, think about the area covered by 1% (2 x 2 m in a 400 m^2 plot), or 0.1% (63 x 63 cm),

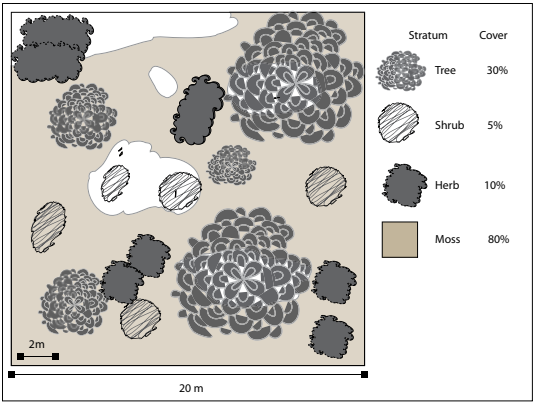


FIGURE 3.3 An example of percent coverages in a plot, viewed from above.

and add up the total number of areas of cover that are roughly equivalent to these dimensions.

- Comparison charts (Figure 3.2) and the example percentage coverage diagram shown in Figure 3.3 are other useful aids.

Recording Percent Cover

Percent cover may be entered in whole numbers (1–100), tenths of a percent (0.1–0.9). While more precise values may be collected, this is only recommended for long-term monitoring plots. For standard ecological plots precision to tenth of a percent is sufficient. Table 3.3 gives examples of the relationship of dimensional area to percentage area, for a 20 x 20 m (400 m^2) plot, and coding.

Blank Columns on the Form

Within the main body of the form, immediately to the left of the columns provided for recording percent cover, two blank columns have been provided for recording additional information. Suggested items that may be recorded here include subdominant substrates (**SS**), distribution codes (**DC**), plant vigour ratings (**VI**),

TABLE 3.3 Dimensions of various areas in a 400 m^2 plot

Dimensions	Area (m^2)	% cover
10 x 10 m	100.0	25.0
5 x 8 m	40.0	10.0
2 x 2 m	4.0	1.0
63 x 63 cm	0.4	0.1
20 x 20 cm	0.04	0.01
6.3 x 6.3 cm	0.004	0.001

phenology (**PV** or **PG**), utilization (**UT**), estimates of available forage (**AF**), arboreal lichen loading (**LL**), Fruit/Flower abundance **(FA)**, and Non-Timber Forest Product Quality **(FP)**. Codes for these items are provided in Appendix 3.1. Enter a two-letter abbreviation for the type of data at the top of each column used. For types of data other than those listed here, explain under Item 11, "Notes."

Completing the Form

Numbered items below refer to circled numbers on the Vegetation Description Form shown at the beginning of this section. A recommended sequence for completing the form is described under **"**Field Procedure."

1. Species List

Certain projects may require a listing of dominant or indicator species only. Check the appropriate box to indicate whether an attempt has been made to record a complete listing of all species on the dominant substrate (**"**Comp.**"**), or if only a partial list has been made (**"**Part.**"**).

2. Percent Cover by Layer

After all species have been listed, enter the total percent cover by layer (see descriptions of layers and instructions for estimating and recording percent cover at the beginning of this section). Note that because of overlaps the sum of the percent cover values for all species within each layer may be greater than the total layer coverage.

3. Surveyor(s)

Record the first initial and last name of the person(s) who described the vegetation.

4. Plot Number

Record plot number from the Site Description Form.

5. Page __ of __

If more than one page is required, enter the number as a total and number each page.

6. Collected

Mark this column if a species has been collected.

7. Species

Enter appropriate 7-letter species or 8-letter subspecies/variety code for each observed species in the appropriate layer section. If uncertain of the correct code, write the entire scientific name. Use the "Additional Species" section to list species from the E layer (epiphytes), additional species from any other layer if there has

been insufficient space elsewhere on the form, and for species growing on sub-dominant substrates. Species codes can be found at www.for.gov.bc.ca/hre/becweb/resources/codes-standards/index.html.

8. Percent Cover

Estimate percent cover for each species. Trees and Shrub species covers must be estimated by both strata and layer (A1, A2, A3, A, B1, B2, B). If trees in A1 are veterans, record this under Item 10, "Notes." For each of the A and B layers, the total percent coverage for a species may be less than the sum of the covers for each of the sub-layers, due to crown overlap.

9. Additional Information

Two columns are provided in each layer section for coding of additional species information. Standards for some possible additional information types are outlined in Appendix 3.1. Write the type code at the top of the appropriate column and record the additional information code for each species relevant to the project objectives. Additional information about the codes and assessments should be made in project metadata.

10. Notes

Use this space to record important features not described elsewhere, or for explanatory notes keyed to other entries on the vegetation form.

Appendix 3.1 Coding for Additional Information

Arboreal Lichen Loading (LL)

A general assessment of lichen loading can be recorded by tree species, by lichen species, or by function group on the vegetation description form. Assess standing live and dead trees for lichen loading. For caribou forage projects assess branches within 4.5 m of the ground or root collar. Assign an overall rating (0–5) by species by comparing with photos in *Estimating the Abundance of Aboreal Forage Lichens* (Armleder et al. 1992). A value of 0 indicates no lichens. If trees have lichens, but none are below the 4.5 m mark, rate as zero.

For biodiversity studies, assess epiphytic lichen (and bryophyte) abundance for the entire trees. Record lichen abundance by tree species, or record abundance by epiphyte species or functional group (e.g. hair lichens, cyanolichens, mosses).

Lichen Abundance Codes

Code	Description
0	None
1	Rare: 1 or 2 colonies per tree
2	Occasional: 3 to 5 colonies per tree
3	Common: 6 colonies to 20% cover per tree
4	Very Common: from 21 – 50% cover per tree
5	Abundant: 51% or great cover per tree

Most species fit into 3 category, 2 and 4 are reserved for unusually uncommon or unusually common, and 1 and 5 are for exceptional sparsity or abundance.

Available Forage (AF)

The amount of available forage may be estimated or measured in g/m^2 and recorded by species in one of the blank columns. If estimated for groups of species, such as palatable forbs, grasses, browse species, undesirable species, etc., record under item 11, "Notes." Also indicate whether forage was measured or estimated and note the method of determining weight (i.e., estimated green, air-dried, or oven-dried).

Distribution Codes (DC)

The spatial distribution pattern of individuals of each species is described using the following codes:

Code	Description	No. plants[a] in 400 m^2
1	Rare individual, single occurrence	1
2	A few sporadically occurring individuals	2–5
3	A single patch or clump of a species	1 patch (< 25% of plot)

Code	Description	No. plants[a] in 400 m²
4	Several sporadically occurring individuals	≥6
5	A few patches or clumps of a species	2–5 patches, each <25% of plot
6	Several well-spaced patches or clumps	≥6 patches, each <25% of plot
7	Continuous uniform occurrence of well-spaced individuals	many
8	Continuous occurrence of a species with a few gaps in the distribution	many
9	Continuous dense occurrence of a species	many

[a] guidelines for low shrubs, herbs, and mosses

Utilization Ratings (UT)

Coding for utilization (present use) of browse and forage species is as follows:

Code	% utilization	Description
0	0	Nil
1	1-15	Slight
2	16-36	Light
3	36-65	Moderate
4	66-80	Heavy
5	> 80	Extreme

Coding for Vigour (VI)

Plant vigour is described using the following codes:

Code	Description
0	Species dead
1	Vigour poor
2	Vigour fair
3	Vigour good
4	Vigour excellent

Phenology Codes: Vegetative Stages (PV)

Deciduous trees or shrubs

Code	Description
0	Closed bud
1	Buds with green tips
2	Green leaf-out, but not unfolded
3	Leaf unfolding up to 25%
4	Leaf unfolding up to 50%
5	Leaf unfolding up to 75%
6	Full leaf unfolding
7	First leaves turned yellow
8	Leaf yellowing up to 50%
9	Leaf yellowing over 50%
10	Bare

Herbs

Code	Description
0	Without shoots above ground
1	Shoots without unfolded leaves
2	First leaf unfolded
3	2 or 3 leaves unfolded
4	Several leaves unfolded
5	Almost all leaves un folded
6	Plant fully developed
7	Stem and/or first leaves fading
8	Yellowing up to 50%
9	Yellowing over 50%
10	Dead

Conifers

Code	Description
0	Closed bud
1	Swollen bud
2	Split bud
3	Shoot capped
4	Shoot elongated
5	Shoot full length, lighter green
6	Shoot mature, equally green

Grasses

Code	Description
0	Without shoots above ground
1	Shoots without unfolded leaves
2	First leaf unfolded
3	2 or 3 leaves unfolded
4	Beginning of development of blades of grass
5	Blades partly formed
6	Plant fully developed
7	Blades and/or first leaves turning yellow
8	Yellowing up to 50%
9	Yellowing over 50%
10	Dead

Phenology Codes: Vegetative Stages (PV) (continued)

Ferns

Code	Description
0	Without shoots above ground
1	Rolled fronds above ground
2	First frond unfolded
3	2 or 3 fronds unfolded
4	Several fronds unfolded
5	Almost all fronds unfolded
6	Plant fully developed
7	First fronds fading
8	Yellowing up to 50%
9	Yellowing over 50%
10	Dead

Phenology Codes: Generative Stages (PG)

Trees, shrubs, and herbs

Code	Description
0	Without blossom buds
1	Blossom buds recognizable
2	Blossom buds strongly swollen
3	Shortly before flowering
4	Beginning flowering
5	In bloom up to 25%
6	In bloom up to 50%
7	Full bloom
8	Fading
9	Completely faded
10	Bearing green fruit
11	Bearing ripe fruit
12	Bearing overripe fruit
13	Fruit or seed dispersal

Grasses

Code	Description
0	Without recognizable inflorescence
1	Inflorescence recognizable, closed
2	Inflorescence partly visible
3	Inflorescence fully visible, not unfolded
4	Inflorescence unfolded
5	First blooms pollenizing
6	Up to 50% pollenized
7	Full bloom
8	Fading
9	Fully faded
10	Bearing fruit
11	Fruit or seed dispersal

Ferns

Code	Description
0	Sori absent
1	Sori green, forming
2	Sori mature, darker, drier
3	Sori depressing, strobili forming in lycopodium

Fruit and Flower Abundance (FFA)

Fruit may be assessed during the flower, green or ripe stage; identify which stage was used within 'notes'. Flower abundance and, to some extent, green fruit abundance should be coded conservatively to take into account loss prior to ripening. Be aware of dioecious species (e.g. *Shepherdia canadensis*); male plants will never bear fruit. Be mindful that typical fruit production varies greatly amongst species; for example, 'high' ratings (Code = 5) will range from *Shepherdia canadensis* (~ 1700 mL /m2), to *Vaccinium membranaceum* (~ 500 mL/ m2), to *V. caespitosum* (~ 150 mL/m2). For detailed information on selected species, see http://cle.royalroads.ca/node/205.

Code	Description	Detail
0	Nil	Plant is moribund or dead.
1	Very low	No fruit structures present or fruit are generally not fit for consumption.
2	Low	Few fruit present; a person would not bother stopping to pick. Fruit and plants are of low to medium vigour and appearance.
3	Moderate	Sufficient fruit, on average, to warrant personal collection (e.g. for a pie).
4	Moderate high	Sufficient fruit per plant, on average, to warrant personal to significant collection. A person would find it worthwhile to come to the area to pick.
5	High	Sufficient fruit per plant, on average, to definitely warrant significant collection (e.g. for winter storage or commercial use). Fruit and plant are of high vigour and appearance.
6	Excellent	Almost all of the plants have exceptional levels of fruit production. Uncommon.

Non-Timber Quality (NTQ)

These codes are used to assess the quality of non-timber forest products (NTFPs, also termed cultural use plants or botanical forest products). Be mindful that quality and cover are separate values; evaluate the quality based on an average of the individual plants within the plot, regardless of the overall cover of the species. If assessing multiple features of a single species, use separate columns (e.g. one column for fruit, the second column for foliage), and indicate the feature at the top of the column (i.e. "RS" for rooting structures; "FR" for fruit; "FO" for foliage; "BA" for bark; "BO" for boughs; "SA" for sap).

For detailed information on selected species, see http://cle.royalroads.ca/node/205. For foliage, whole plant, rooting structures, sap, bark, determine the code using details specific to the species and the use (ask local harvesters and/or see website, above).

Code	Rating	Detail
0	Nil	Species is dead
1	Poor quality	Low vigour, structures clearly of improper size or with many imperfections(branches too short, roots too large), collection very difficult (e.g. roots in rocky ground, branches inaccessible)
2	n/a	
3	Fair quality	Average vigour and proper size, some imperfections such as insect or fungal damage may be present, collection is not impeded
4	n/a	
5	Good quality	Vigourous plants, many clean, unmarred, optimally proportioned structures, collection relatively easy
6	Excellent quality	Quality is clearly excellent. Abundant easily accessible structures of optimum vigour, size, and proportion. Local users may have indicated the site as highly desirable. Uncommon.

4 MENSURATION

Contents

MENSURATION

MENSURATION				TREE SURVEYOR(S) ①
CRUISE ② ☐ INFORMAL ☐	B.A.F.-A ③ B.A.F.-B	DBH LIMIT ④	PLOT SIZE (m^2) ⑤	PLOT No. ⑥

EXCLUDE ?	SUBPLOT	TREE #	SPP.	DBH (cm)	TOTAL HT. (m)	CNT. HT. (m)	COUNT AGE	CROWN C	TREE C	PATH. REMARKS: CONK	BL. CONK	SCAR	FRK. OR CRK.	F. CRACK	MISTLETOE	R. BRAN.	D. OR B. TOP	DAM.: TYPE	SEVERITY	WILDLIFE / OTHER: CROWN CON.	APPEAR.	BARK RET.	WOOD COND.	LICHEN L	
		⑦			⑧			⑨					⑩					⑪				⑫			

NOTES

FS882 (4) HRE 2008/03

Field Procedure

Getting Started

1. Identify sample trees based on a prism sweep, or if using a fixed-area plot, establish plot boundaries. Be aware of the minimum dbh for the project. (Note: For a tree to be considered countable its point of origin (pith) must be within the plot area).
2. Tag or flag numbers on each tree including all live and dead trees. When numbering trees, start with the tree closest to due north of plot centre and proceed in a clockwise direction.

Measure and Record

1. Enter the header information.
2. Record tree numbers and species of sample trees.
3. Determine and record diameters and age at breast height. If age is to be determined later, place the collected core in a labelled straw.
4. Determine total height.
5. For each sample tree, examine tree and assess pathological indicators, damage codes, and/or wildlife attributes as appropriate for the project.
6. Check that all the required information has been collected and noted on the form. Strike through any fields that were not assessed.

Selecting the Sampling Method

Either a fixed-area or variable-radius plot may be used. Variable-radius plots will be used most commonly, but if the project area is dominated by stands with the following characteristics, a fixed-area plot may be preferable:

- very open stands with widely spaced trees or clumps of trees
- very dense stands where not all trees in a plot would be easily visible

Once selected, the same plot-type should be used consistently throughout the project.

Selecting the Minimum Diameter

The minimum diameter at breast height (dbh) is typically 7.5cm for cruise plots; however the minimum diameter may be determined by the wildlife species of concern in the project—the goal is to sample a reasonable number of trees of an appropriate minimum size for the species. For example, for Bald Eagle interpretations, trees less than 20 cm dbh are not of value and may be ignored. For most projects, the minimum dbh will be 15 cm or greater. Trees less than the minimum dbh are ignored

Selecting a Basal Area Factor Prism

The basal area factor (BAF) prism size should be based on previous experience. A prism size that will provide 7-11 sample trees (greater than or equal to the minimum dbh) per plot is ideal. A minimum of 5 and maximum of 16 trees is required. Generally, the larger the trees, the larger the BAF; the denser the stand, the smaller the BAF required. It may be necessary to have several prisms available throughout a project. When traversing the stand, but before determining the plot location, the prism size should be selected.

Selecting the Plot Size and Shape

For fixed-area plot sampling, a plot size is selected that will provide ten or more sample trees greater than or equal to the minimum dbh. The plot size is determined for a project and is only reduced or increased in exceptional circumstances. The decision of whether to increase or decrease, e.g., double or halve, the plot size is done when entering the stand, before the plot is marked, so as to minimize bias.

Plot shape can be circular, square, or rectangular, but should be determined at the start of a project.

Selecting Stands and Sample Trees for Mensuration

Stand selection criteria will depend entirely on project objectives. If the data is being collected to determine site index, stands should have the following characteristics:

- even-aged (preferably 20–150 years of age)
- dominated by one tree species (or target species > 60% of basal area)
- moderately dense
- ecologically uniform site of at least 400 m^2

When determining site index is not a primary objective, select the two or three largest diameter trees of each species for mensuration. If the data is being collected to determine site index, collect mensuration data on "top-height" trees that meet the following criteria:

- 100 largest diameter trees per hectare (largest 4 per 400 m^2 plot)
- dominant or co-dominant
- not wolf, open grown, or veteran
- straight-stemmed, free of disease, damage, and breakage
- free of suppression (above breast height)
- vigorous, with full crowns

Completing the Form

Numbered items below refer to circled numbers on the Mensuration form shown at the beginning of this section. A recommended sequence for completing the form is described under "Field Procedure."

1. Surveyor
Enter the first initial and last name of the person(s) collecting mensuration data

2. Cruise/Informal
Indicate whether tree attribute data is informal or a formal cruise plot.

3. B.A.F. - A and B.A.F. - B
Enter the standard metric (m^2/ha) Basal Area Factor (BAF) prism used for subplot A and subplot B, if applicable.

4. dbh Limit
Enter the minimum breast height diameter (dbh) in cm being used.

5. Plot Size
Enter the area of the plot in m^2, if applicable.

6. Plot Number
Record the plot number from the Site Description Form.

7. Tree Sample Information

Exclude?
Mark box if measured tree is not to be included in calculations specific to project. (e.g. damaged or diseased trees for site index projects)

Subplot
Indicate subplot A or B if applicable

Tree Number
Record sample tree number. Assign numbers sequentially to each tree sampled. Start with the tree closest to due north of plot centre and proceed clockwise.

Species
Identify and record tree species codes using the codes given in Keys and Codes 9.20.

8. Tree Measurements Information

Diameter at Breast Height
Measure the diameter at breast height (dbh), i.e., 1.3 m, of all live, dead, standing, and fallen sample trees.

- On slopes, breast height is measured from the high side of the tree.
- Measure diameter to the nearest 0.1 cm.
- Hold the diameter tape tight, making no allowance for missing bark.
- If it is not possible to measure dbh accurately because of an obstruction or unsafe conditions, enter an estimate.

Total Height
Enter the total height of the tree (m) to one decimal.

Count Height
Record the height at which the age was taken. This is usually dbh, but can be another value. Enter "0" if taken at the base of tree.

Count Age
Measure age at breast height, 1.3 m above the ground on the high side. If measured at a different height enter this value in Count Height. The core must show the pith for the age to be accurate. Depending on the requirements of the project, counts may be done in the field using a hand lens. If greater accuracy is required, place the core in a plastic straw labelled with the plot and tree number and determine age later in the office. In some cases a microscope may be required to achieve an accurate count.

9. Crown Class and Tree Class

Assign a crown class designation to all standing live trees as follows:

D **Dominant** Trees with crown extending above the general level of the layer; somewhat taller than the codominant trees, and have well developed crowns, which may be somewhat crowded on the sides.

C **Codominant** Trees with crowns forming the general level of the crown canopy; crown is generally smaller than those of the dominant trees and usually more crowded on the sides.

I **Intermediate** Trees with crowns below, but extending into the general level of the crown canopy; crowns usually small and quite crowded on the sides.

S **Suppressed** Trees with crowns entirely below the general level of the crown canopy.

Tree Class - Assign a tree class designation to all standing trees as follows:

Code	Description
1	Older Immature
2	Older Immature Suspect
3	Older Immature Dead Potential
4	Dead Useless
5	Mature
6	Live Useless
7	Mature Dead Potential
8	Younger Immature
9	Younger Immature Dead Potential

10. Pathological Indicators

Defects and pathological indicators are frequently signs of decay or rot in the wood. Identify the type of defect and determine if it is "suspect" (i.e., a probable indicator of decay). If suspect, enter a code under the type of defect observed, and indicate its location on the tree using the codes in Table 4.2.

Conks:
Fruiting bodies of stem decay fungi are reliable indicators of decay. They are typically thick, hard, and woody-like perennial structures that may appear anywhere on the main stem or branches, but that usually appear around knots and on the underside of dead branch stubs and live branches.

Blind conks:
"Swollen knots" (see Figure 4.1) are reliable indicators of decay. They appear as pronounced swellings or depressions around knots and are thought to represent an attempt to heal over decay emerging though a knot or branch stub. Bright yellow or buff-coloured material is found by chopping into basal branch stubs. Blind conks most often occur in the Interior.

TABLE 4.1 Defect location codes

Code	Defect occurrence on tree
1	Lower third only
2	Middle third only
3	Upper third only
4	Lower and middle thirds
5	Middle and upper thirds
6	Lower and upper thirds
7	Entire tree

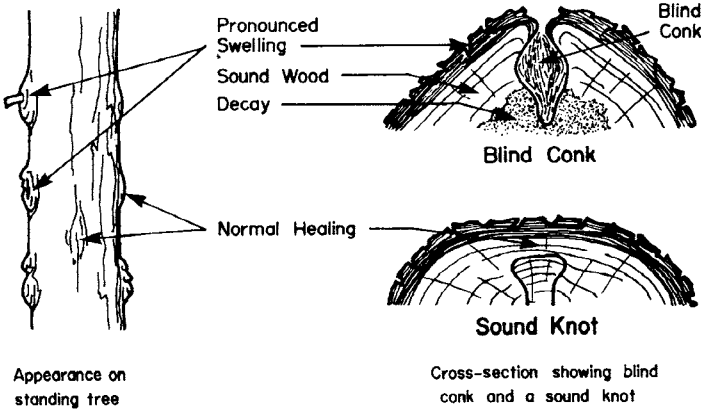


FIGURE 4.1 Blind conk and sound knot, on a standing tree and in cross-section.

Scars:
Scars result from past injuries caused by external forces that have damaged the cambium or heartwood, exposing the tree to wood decay fungi. These scars are considered suspect if located on the main stem or root collar, unless they are of recent origin (Figures 4.2 and 4.3).

Scars may be open or closed. ***Open scars*** are areas of exposed wood of varying size and shape from severe damage caused by fire, lightning, logging, machinery, etc. ***Closed scars*** may appear healed over, with slight to pronounced indentations of the bark, or there may be pronounced scar tissue or callous growth, often with abundant resin flow.

Several common types of scars are described below.

Fire scars – may appear as indentations, open catfaces, or hollowing of the trunk; usually confined to base of trunk.

Lightning scars – extensive damage to the trunks and tops of trees; strips of torn wood typically observed, often extending the entire length of the tree in a spiral.

Falling-tree scars – the fallen tree generally found against or near the scarred tree.

Logging or other machinery scars – selective cutting operations may cause extensive damage; usually on the base of the trunk, or the upper portion of the trunk if caused by rigging.

Old blazing – frequent entry points for wood-rotting fungi; do not record recent blazing.

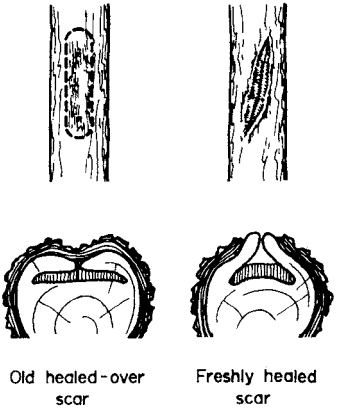


FIGURE 4.2 Appearance of scars that are old or freshly healed.

Scars caused by breakage – scars on trunks from the breakage of live branches or secondary leaders; breakage caused by high winds, heavy snow, or branches falling from adjacent trees.

Animal or bird scars – for example, woodpeckers can make large, deep holes in the trunk; bears, deer, moose, and elk may remove areas of bark and cambium; scars can be caused by bear claws and gnawing by beavers or other rodents.

Cankers caused by fungi – results in the death of localized areas of bark and cambium (Figure 4.4); dead bark is sloughed off, exposing underlying wood; usually evidence of repeated callous growth; may be mistaken for "mechanical" scars; usually flattened, elongated, and of irregular shape; exposed wood often stained and impregnated with resin; fruiting bodies of the fungus may be visible.

Scars caused by rock slides or falling rock – usually confined to base of trunk, however falling rock sometimes causes scars much higher on stem because of high snow levels or rocks bouncing; usually occur on the upslope side (Figure 4.5).

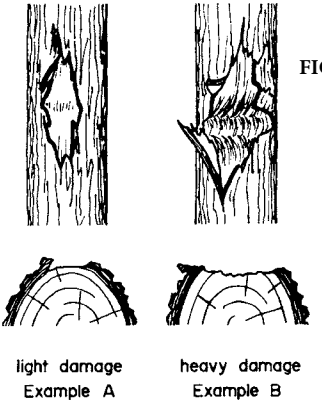


FIGURE 4.3 Appearance of scars with light or heavy damage.

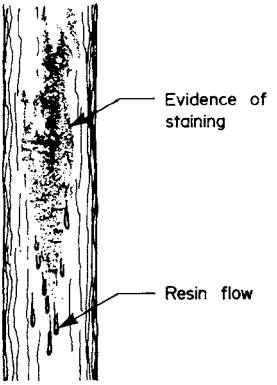


FIGURE 4.4 Appearance of cankers caused by fungi.

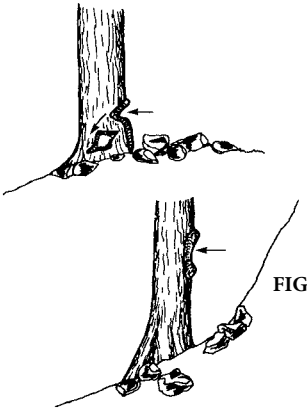


FIGURE 4.5 Appearance of scars caused by rock slides or falling rock.

Fork or crook (F or C):
Forks or crooks that develop after an early injury to the top of the tree are reliable indicators of decay (Figure 4.6). The following are not considered forks: candelabra branches; natural branching in deciduous trees; small, sharply angled branches or spikes, unless associated with a noticeable offset or diameter change at the location; flattening of tree tops caused by wind or physiological conditions where no terminal leaders are evident.

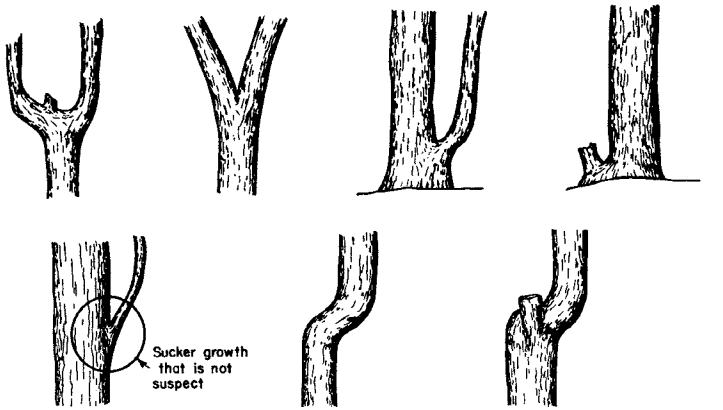


FIGURE 4.6 Appearance of different forms of forks and crooks.

Frost cracks (F. Crack):
Frost cracks are caused by uneven expansion of moisture in the tree following a sudden and pronounced drop in temperature. They result in deep radial splitting of the trunk and are considered suspect. Usually originating at the base of the trunk, frost cracks may extend many metres up the tree. These cracks are often re-opened by wind stresses or low temperatures; repeated healing of the wood produces considerable callous tissue, giving the wound a pronounced ribbed appearance (Figure 4.7).

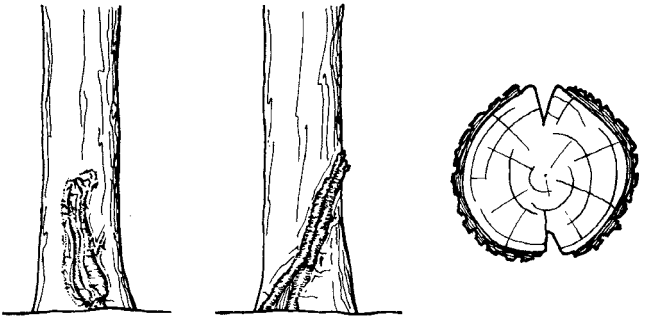


FIGURE 4.7 Appearance of frost crack on standing tree and in cross-section.

Mistletoe (Mistle):
Mistletoe infection may be indicated by either abnormal swelling or malformation of the trunk (see Figure 4.8A), or by clusters of dead and broken branches on the trunk, or on swollen branches adjacent to the trunk (see Figure 4.8B). Infection on branches should be noted only where swelling has extended to within 30 cm of the trunk (Figure 4.9).

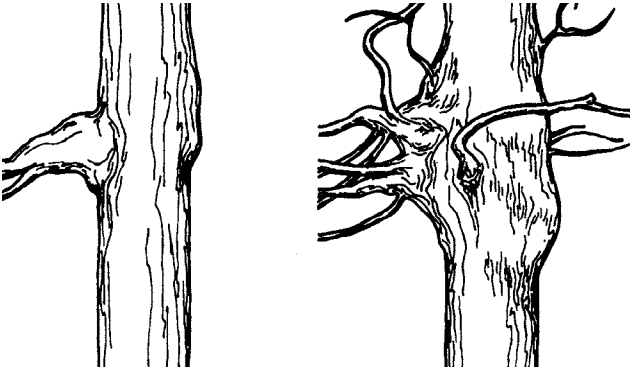


FIGURE 4.8 Examples of mistletoe infection.

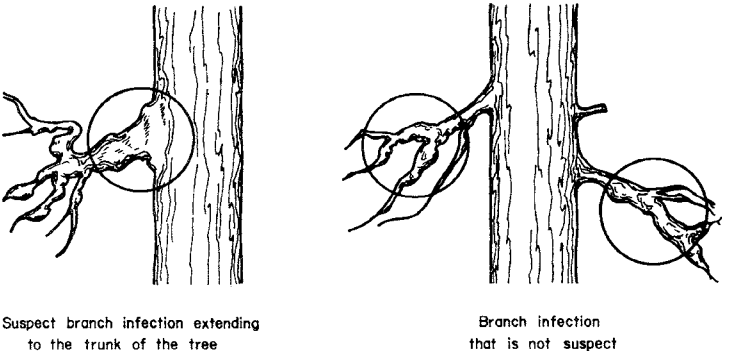


FIGURE 4.9 How to determine if mistletoe infection causes tree to be suspect.

Rotten Branch (R. Bran.):
Large, rotten branches, typically on old-growth trees often indicate decay. Note only those branches that are greater than or equal to 10 cm in diameter at the base and that are clearly rotten (usually on overmature trees) (see Figure 4.10A). Do not include small, dead branches typically just below the live crown or on the lower trunk of open-growntrees (see Figure 4.10B).

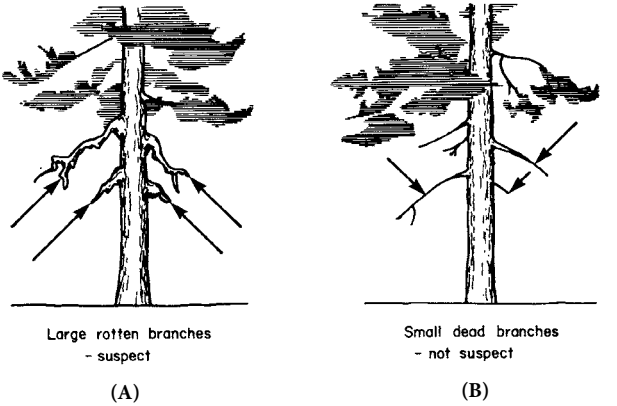


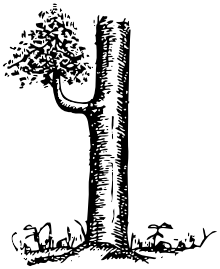
FIGURE 4.10 How to determine if rotten branches are a probable indicator of decay.

Dead or broken top (D. or B. Top):
These may be caused by wind, snow, mechanical damage from other falling trees, etc. Only note those not recent in origin (i.e., must be obviously weathered).

Non-suspect abnormalities:
The following features should ***not*** be recorded as "suspect" pathological indicators.

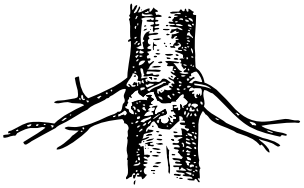
External evidence of butt rot not associated with suspect abnormalities
Butt rot may be evident in exposed roots or within root crotches. However, unless one or more abnormality which is considered suspect also appears on the tree, do not consider butt rot as an indicator of decay.

Flutes Pronounced flutes in the trunk (illustrated right) are characteristic of many species and do not signify decay.

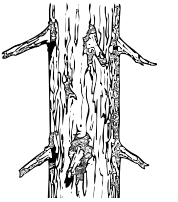


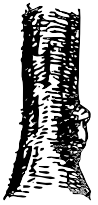
Candelabra branches Candelabra branches (illustrated left) develop as a result of abnormal branch growth and do not signify decay. They may be confused with suspect forking; unlike forks, however, they do not originate in the trunk of a tree.

Branch fans A branch fan (illustrated right) develops through abnormal branching, appearing most commonly as a 'fan' of branches which originates from a burl-like swelling on the trunk. These are not considered suspect.

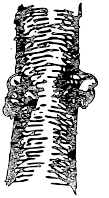


Black knots Black knots (illustrated right) frequently develop around unhealed knots and wounds. A superficial saprophytic fungus feeding on exuded sap causes the blackness. These do not signify decay.





Burl

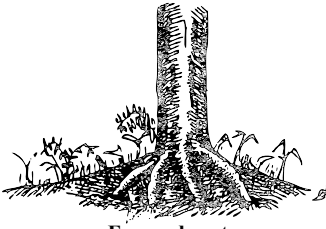


Gall

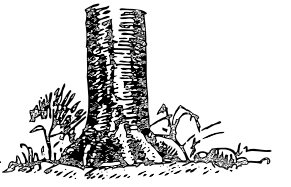
Burls and galls Burls and galls (illustrated left) develop from abnormal cell growth in trees. Although formidable in appearance, they do not signify decay.

Sweep Sweep refers to a slight curvature or distortion of the trunk (illustrated right). This does not indicate decay.

Exposed roots Exposed roots and buttress roots (shown below) do not signify decay unless scarring is present above the point of germination.



Exposed roots



Buttress roots

Spiral grain Spiral grain is a growth characteristic of some trees and does not signify decay.

Dry side Dry side results from the death of the cambium through bruising by other trees or other physiological causes. It appears as a narrow to wide strip or small localized area on the side of a tree, with the bark often remaining intact over the dead areas. Does not signify the presence of decay.

Sapsucker holes Sapsucker holes are superficial and do not signify decay. Do not confuse with the deeper scarring of woodpeckers.

Suspect scarring by woodpecker

Non-suspect sapsucker holes

Insect borings Borings by bark beetles or by other insects do not signify decay and are non-suspect.

11. Damage Type and Severity

Specify the type of damage agent and severity of effect on the tree. Damage agents may include insects, diseases, wildlife, competing vegetation, or abiotic agents. If more than one type occurs on the same tree, record the most damaging one.

Type of Damage (Type):
Specify the type of damage agent using codes listed in Keys and Codes 9.21.

Severity of Damage (Sev.):
Rate the severity of the effect on the tree. Either assess subjectively using the following codes or leave blank (severity is difficult to assess without training).

L = Low
M = Moderate
S = Severe
P = Past attacks

5 WILDLIFE HABITAT ASSESSMENT

Contents *Page*

BRITISH COLUMBIA

WILDLIFE HABITAT ASSESSMENT

Proj. id. (1) | Date (2) y m d | N-hab. feature type (5) dst. | page of (6)

Plot no. (3) | Surveyor (4)

Species	Hab use / Ssn		Plot type				Plot-in-context													
5-letter code	Sp. L.R.	Ssn.	FD	SH	TH	Com.	Habitat feature	Conf.	Distance (km)	F/C L.R.	Imp.	Habitat feature	Conf.	Distance (km)	F/C L.R.	Imp.	FD	SH	TH	Suit.	Com.
(7)	(8)			(9)							(10)									(11)	(12)

Comments / Notes

FS882 (5) HRE 2008/03

BRITISH COLUMBIA

WILDLIFE HABITAT ASSESSMENT

Project id. | **Plot no.**

Evidence of Use

Inside plot							Outside plot and inside ecosystem unit									
Species	Sex	Life Stage	Activity	Des.	No.	Com.	Sex	Life Stage	Activity	Des.	No.	Sex	Life Stage	Activity	Des.	No.	Com.
13	14	15	16	17	18	19	14	15	16	17	18						19

Comments / Notes

Abbreviated Tree Attributes for Wildlife

B.A.F. 20		Area 21		Min DBH 22	
No. of trees 23		No. dead 24		No. live 25	
Avg. DBH (cm) 26		Avg. length (m) 27			
Avg. lich load class 28		Comments 29			

Simple Coarse Woody Debris

Sampled 30 m of 30 m transect

Piece #	1	2	3	4	5	6	7	8	9	10	11
Decay class 31											
Diam. class 32											
Piece #	1	2	3	4	5	6	7	8	9	10	11
Decay class											
Diam. class											
Comments 33											

Management

Species (Sp. group)	Use	Ssn.	F/C LR(s)	Cap.	Mgmt. Tech.	M. Feat / Int	Comments / Notes
34	35	36	37	38	39	40	41

FS882 (5) HRE 2008/03

Field Procedure

Getting Started

1. Determine plot boundaries in consultation with other surveyors.
2. Become familiar with the character of the terrain, soil, and vegetation by traversing the plot and consulting with plant ecologist and soil scientist.

Record and Classify

1. Enter the date, plot number, and name(s) of wildlife surveyor(s).
2. Record evidence of use in plot and in ecosystem unit represented by the plot.
3. List project species and additional species noted during visit.
4. Record habitat use and season for each species.
5. Confer with plant ecologist and soil scientist about site classification, values, and site management concerns.
6. Ensure that relevant wildlife habitat data is filled out on the site description and vegetation forms.
7. Complete coarse woody debris and tree attributes for wildlife forms, if required.
8. Assess the value of the plot-type for each species (not necessary for incidentally recorded species). Be sure that the plot-type assessment is completed before the plot-in-context assessment.
9. Assess the value of the plot-in-context for each species based on the spatial context of the plot.
10. Record comments at the bottom of the form, cross-referencing to species.
11. Photograph the plot to illustrate important wildlife habitat features or evidence of animal use.
12. Check that all the required information has been collected and noted on the form. Strike through any fields that were not assessed.

Completing the Form

The purpose of this form is to assess habitat for its value to wildlife and to record evidence of its usage by wildlife. For inventories of wildlife populations, use forms provided in *Standardized Inventory Methodologies for Components of British Columbia's Biodiversity* (Resources Inventory Committee: Elements Working Group 1996) manuals. To record observations of wildlife outside of the ecosystem unit represented by the plot, use the Wildlife Sighting Form available from the B.C. Conservation Data Centre. The Wildlife Sighting Form should be used for observations of all Red and Blue-listed species.

Numbered items below refer to circled numbers on the Wildlife Habitat Assessment Form shown at the beginning of this section. A recommended sequence for completing the form is described under "Field Procedure."

1. Project ID
Identify the project as shown on the Site Description form.

2. Date
Enter the two-digit codes for year, month, and day.

3. Plot Number
Record the plot number from the top of the Site Description Form.

4. Surveyor(s)
Enter the first initial and last name and of each person involved in completing this form.

5. Non-habitat Features
Enter up to two types of human activity or other non-habitat feature (N-hab. feat.) near the plot that may affect usage by wildlife. A non-habitat feature is a feature of the environment that influences the amount of use of the plot by wildlife. A non-habitat feature can be distinguished from a habitat feature because non-habitat features do not affect habitat attributes (i.e., something measurable to describe habitat) and therefore do not affect suitability.

Type:
Identify the type of prolonged human activity or other non-habitat feature near the plot using the codes in Table 5.1.

TABLE 5.1 Codes for types of non-habitat features [a]

Code	Type
AI	Airport (e.g., noise from airplanes and human presence)
FA	Farming
FE	Fence
GD	Garbage dump
LO	Logging activity
MI	Mining activity
OT	Other (specify under "Comments")
RF	Road traffic, four lanes
RO	Road traffic, one lane
RN	Railroad (e.g., noise from trains and human presence)
RT	Road traffic, two lanes
RR	Rural (e.g., pressure from human activity)
UR	Urban/suburban (city, town, village) (e.g., pressure from human activity)

[a] This is not a comprehensive list of non-habitat features. For example, disease and depredation are also examples of non-habitat features that would influence plot-type usage. Such non-habitat features which are difficult to identify can be noted under the comments section.

Distance:
Enter a code (1–5) indicating the approximate distance (dst.) from the plot to the nearest sites of prolonged human activity or other non-habitat features which may affect wildlife.

TABLE 5.2 Codes for distances to nearest non-habitat features

Code	Distance
1	0–100 m
2	100–250 m
3	250–1000 m
4	1–5 km
5	> 5 km

6. Page ___ of ___

If more than one Wildlife Habitat Assessment Form is required for this plot, enter the number of forms used as a total and number each page.

7. Species

Indicate the species for which the habitat is being assessed. Use the five-letter codes from Cannings and Harcombe (1990), plus additional codes given in Appendix 5.1.

8. Habitat Use

For each habitat use (Hab use) to be assessed, use one row on the form.

Specified Life Requisite:
Specify the life requisite (SpLR) for which the habitat will be used with a two-letter code from Table 5.3.

TABLE 5.3 Specified life requisite codes

Code	Specified life requisite	Description
AP[a]	Avoiding pests	Habitat used for avoiding pests; e.g., caribou use snow fields to avoid insects in summer
CO	Courting	Habitat used for courting; involves enticing a conspecific of the opposite sex into copulation, courtship feeding, and defense of mates
DE	Denning/Roosting	Habitat used for sleeping or hiding in a cavity, cave, or burrow; does not include hibernating nor reproducing-birthing
FS	Feeding - Salmon	Habitat used for feeding on fish during a salmonid run
HI	Hibernating	Habitat used for hibernating
LI[a]	Living	Habitat used for activities other than; denning, birthing, courting etc.
MD[a]	Migrating daily	Habitat used for regular, daily travelling, including travelling away from or towards a communal habitat; e.g., habitat used by a bat for daily flights to and from a roosting site
MS[a]	Migrating seasonally	Habitat used for regular, annual travelling; e.g., habitat used by elk for spring and fall migrations, or habitat used for travelling away from or towards a communal habitat such as a hibernaculum
RB	Reproducing - Birthing	Habitat used specifically for giving birth to live young; e.g., caribou use specialized habitat for birthing but beaver do not; habitat used by amphibians, birds, and reptiles for hatching of eggs is recorded as habitat used

TABLE 5.3 Specified life requisite codes (continued)

Code	Specified life requisite	Description
		for reproduction by eggs (RE)
RE	Reproducing - Eggs	Habitat used for building a nest, laying eggs, incubation, hatching, and feeding non-mobile young; reserved for amphibians, birds, and reptiles; specialized habitat used by some mammals to give birth to young is recorded as reproducing-birthing (RB) habitat
SG[a]	Staging	Habitat used for staging during spring or fall migrations

[a] Activities for which a season needs to be indicated (see below). The season is implied for all other activities.

Season:
If required, indicate the season (Ssn.) for which the habitat is being assessed. Use codes listed in Table 5.4. Consult *B.C. Wildlife Rating Standards* (Resources Inventory Committee: Wildlife Interpretations Subcommittee 1998) for recommended season coding system for each species.

TABLE 5.4 Codes for season of use

Code	Season	Code	Season
Aa	All seasons	**WE**[a]	Early Winter
G	Growing	**WL**[a]	Later Winter
W	Winter	**PE**[a]	Early Spring
P	Spring	**PL**[a]	Late Spring
S	Summer		
F	Fall		

[a] Early Spring, Late Spring, Early Winter and Late Winter seasons should only be used for M-URAR, M-URAM and M-RATA. Also, Early Spring can be used to distinguish Early Spring feeding habitat from Spring feeding habitat for M-ODVI and M-ODHE.

9. Plot-Type Assessment

Assess the food, security habitat and thermal habitat provided by the plot type for the species, use and season being considered. For these assessments, disregard plot size and shape, and position relative to other habitats. Instead, imagine that the plot type covers a sufficiently large area to maximize its value for the species, use and season being considered. These data will be used to establish suitability ratings for the ecosystem unit represented by the plot. For assessments of relative quality and suitability use codes in Table 5.5.

For species where it is known that thermal habitat plays a significant role in overall suitability, but for which thermal qualities of the plot type cannot be assessed separately from the security qualities, do not attempt to enter a rating in the TH column—only use the SH column to enter a rating.

TABLE 5.5 Relative quality classes for assessing the plot type quality relative to the best in British Columbia

Class Quality	Suitability/ capability	Lower limit (%)	Upper limit (%)	
1	High	>75	≤100	Equivalent
2	Mod. high	>50	≤75	Slightly less
3	Moderate	>25	≤50	Moderately less
4	Low	>5	≤50	Substantially less
5	Very Low	>0	≤5	Much less
6	Nil	0	0	Habitat or attribute is absent

Food:
For species that require food (FD) for the use and season being considered, rate the ability of the plot type to fulfill food requirements.

Security habitat:
For species that require security habitat (SH) for the use and season being considered, rate the ability of the plot type to fulfill security requirements.

Thermal habitat:
For species that require thermal habitat (TH) for the use and season being considered, rate the ability of the plot type to fulfill thermal requirements.

Comments:
To provide additional information about the plot-type assessment, or to clarify an entry made on this line, enter a numeric code (Com.). Enter the same code in the Comments/Notes section of the form, followed by the pertinent information.

10. Plot-in-Context Assessment

Given the location of the plot, assess the quality and accessibility of food, security and thermal habitat for the species, use, and season being considered. This assessment includes the adjacent habitat features that are accessible to the species, for the specified use and season. The data will be used to develop a suitability rating for the specific plot in the area. For assessments of quality and suitability use coding from Table 5.5.

Habitat features:

A habitat feature is a feature of the environment that influences the amount of use of the plot by providing food, security or thermal habitat and thereby affects suitability (e.g., a nearby agricultural field may provide food and influence plot usage). Enter up to two habitat features (Table 5.6) that may affect suitability of the plot.

TABLE 5.6 Habitat features codes for plot-in-context assessment [a]

Code	Habitat feature	Definition
AL [b]	Alkaline pond	Body of fresh water with a pH greater than 7 and a depth less than 2 m [c]
AS	Aspect	Area which has an aspect associated with it, in which the aspect is the attribute important to the species, use, and season being considered
BE [b]	Beach	Area of sorted sediments reworked in recent time by wave action; at the edge of fresh or salt water bodies [d]
BF [b]	Blockfields, Blockslopes, Blockstreams	Level or gently sloping areas covered with moderately sized or large, angular blocks of rock derived from the underlying bedrock or drift by weathering and/or frost heave [c]
BU	Building	
CA [b]	Canal	Artificial watercourse created for transport, drainage, and/or irrigation purposes
CB [b]	Cutbank	Part of a road corridor or river course situated upslope of the road or river; created by excavation and/or erosion of the hillside [d]
CF [b]	Cultivated field	Flat or gently rolling, non-forested, open area subject to human agricultural practices
CH	Clearcut, herbaceous	

TABLE 5.6 Habitat features codes for plot-in-context assessment (continued)

Code	Habitat feature	Definition
CL [b]	Cliff	Steep, vertical or overhanging rock face [e]
CO [b]	Cultivated orchard	Agricultural area of fruit trees planted in rows
CS	Clearcut, shrubby	
CU	Clearcut, unvegetated	
CV [b]	Cultivated vineyard	Agricultural area of grapes planted in rows
ES [b]	Exposed soil	Area of exposed soil; not included in any of the other definitions [d]
ET	Electrical transmission line	
EY	Estuary	
FC	Forest, commercially thinned	
FE	Fence	
FM [f]	Forest, mature	
FO [f]	Forest, old	
FY [f]	Forest, young	
GB [b]	Gravel bar	Elongated landform generated by waves and currents; a mix of cobbles, pebbles, stones, and/or sand
GC [b]	Golf course	Grass-covered fairways and open areas for the playing of golf
GL [b]	Glacier	Mass of perennial snow and ice [d]
GP [b]	Gravel pit	Area exposed for the removal of sand and gravel [d]
GR	Grassland	
LA [b]	Lake	Naturally occurring, static body of water > 2 m deep (> 50 ha) [d]

TABLE 5.6 Habitat features codes for plot-in-context assessment (continued)

Code	Habitat feature	Definition
LB [b]	Lava bed	Area where molten rock has flowed from a volcano or fissure and cooled to form solidified rock [d]
MI [b]	Mine	Unvegetated area for the extraction of mineral ore and other materials [c]
MO [b]	Moraine	Unvegetated landform of unstratified glacial drift [g]
MU [b]	Mudflat sediment	Flat plain-like areas of fine-textured sediment [d]
NB	Nest boxes	
OT	Other	
OW [b]	Shallow open water	Wetland of permanent shallow open water (< 2 m deep); lacking extensive emergent plant cover
PA	Pasture	
PD [b]	Pond	A small body of water > 2 m deep (< 50 ha)
PI	Pipeline right-of-way	
PS [b]	Permanent snow	Snow or ice, not part of a glacier, but found during summer months [d]
RD	Ridge	Area which has a ridge associated with it; the ridge is the feature important to the species, use, and season being considered
RE [b]	Reservoir	Artificial basin created by the impoundment of water behind a human-made structure such as a dam, berm, dyke, or wall [d]
RI [b]	River	Watercourse formed when water flows between continuous, definable banks [d]
RN [b]	Railway surface	Roadbed with fixed rails for possibly single or multiple rail lines [d]

TABLE 5.6 Habitat features codes for plot-in-context assessment (concluded)

Code	Habitat feature [a]	Definition
RO [b]	Rock outcrop	Gentle to steep, bedrock escarpment or out cropping, with little soil development and sparse vegetation
RP [b]	Road surface	Area cleared and compacted for vehicle trans port [d]
RR [b]	Rural	Area of residences and other human developments scattered and intermingled with forest, range, farm land, and native vegetation or cultivated crops [c]
RU [b]	Rubble	Small angular rock fragments (between 2 and 256 mm) deposited by gravity or ice [d, g]
SW [b]	Saltwater	Body of water that contains salt or is considered to be salty [d]
TA [b]	Talus	Large angular rock fragments at the foot of steep rock slopes as a result of successive rock falls [d, g]
UR [b]	Urban/ suburban	Area of residences and other human developments form an almost continuous cover [c]
VH	Avalanche track, herbaceous	
VS	Avalanche track, shrubby	

a This is not a comprehensive list of habitat features. Other habitat features can be recorded by using the OT code and adding a comment.

b Habitat features derived from Table 3.1 Symbology and definitions for non-vegetated, sparsely vegetated, and anthropogenic units in Standards for Terrestrial Ecosystem Mapping in B.C.

c adapted from Dunster and Dunster (1996)

d adapted from Resources Inventory Committee (1997)

e adapted from Sinneman (1992)

f To identify old, mature and young forest, refer to definitions provided in Item 26, Site Description section.

g adapted from Howes and Kenk (1997)

Confidence:
Use the codes in Table 5.7 to identify a level of confidence (Conf.) in the assessment of habitat features (i.e., how confident you are that the habitat feature affects the species, use, and season being considered). Base this on your knowledge of the species' habitat requirements and on your knowledge of the quality and quantity of habitat present in the habitat feature.

TABLE 5.7 Confidence level codes for assessment of habitat features

Code	Level of confidence	Description
1	Confident	Excellent knowledge of habitat attributes available in the habitat feature **and** of species' habitat requirements
2	Moderately confident	Excellent knowledge of habitat attributes avail able in the habitat feature **and** moderate knowledge of species' habitat requirements; **or**, moderate knowledge of habitat attributes available in the habitat feature **and** excellent knowledge of species' habitat requirements
3	Not confident	Moderate knowledge of habitat attributes available in the habitat **and** of species' habitat requirements

Distance:
Indicate, in kilometres, the distance from plot centre to the habitat feature.

Food/Cover life requisite:
Identify the food/cover life requisite (F/C L.R.) (Table 5.8) that the described habitat feature provides. If the habitat feature provides more than one life requisite, then use a combination of codes (e.g., FS indicates that both food and security are provided by the habitat feature).

TABLE 5.8 Food/cover life requisite codes

Code	Food / cover life requisite	Description
F	Food	Provides habitat used for consuming food items, including searching for and consuming food simultaneously such as is done by grazers, brows ers, flying insectivores, ducks, and other species with similar feeding habits; includes habitat used for searching for, pursuing and killing prey

TABLE 5.8 Food/cover life requisite codes (continued)

Code	Food / cover life requisite	Description
S	Security	Provides habitat used for protection or hiding from predators
T	Thermal	Provides habitat used for protection from heat, cold, or precipitation

Impact:
Assess the impact (Imp.) of the habitat feature using codes from Table 5.9. Given the presence of the habitat feature, the impact is a measurement of the increase or decrease in the quality and accessibility of the food/cover life requisite(s) relative to to quality and accessibility if the plot type extended indefinitely.

TABLE 5.9 Impact of habitat feature on suitability rating

Code	Description
1	Large increase
2	Moderate increase
3	Low increase
4	No effect
5	Low decrease
6	Moderate decrease
7	Large decrease

Food:
Considering the context of the plot, for species that require food (FD) for the use and season being considered, rate the overall quality and accessibility of food. Use coding from Table 5.5.

Security habitat:
Considering the context of the plot, for species that require security habitat (SH) for the use and season being considered, rate the overall quality and accessibility of security habitat. Use coding from Table 5.5.

Thermal habitat:
Considering the context of the plot, for species that require thermal habitat (TH) for the use and season being considered, rate the overall quality and accessibility of thermal habitat. Use coding from Table 5.5.

11. Suitability

Assign a suitability rating (Suit.), using the codes in Table 5.5, for the plot-in-context, for the species, use, and season being considered. Base the suitability on the ratings entered in the food (FD), security habitat (SH), and thermal habitat (TH) columns. Theoretically, the suitability rating should be an average or weighted average of the three food/cover life requisite ratings.

12. Comments

To provide additional information about the habitat assessment, or to clarify an entry on this line on the form, enter a numeric code (Com). Enter the same code in the Comments/Notes section of the form, followed by the pertinent information.

Evidence of Use

Complete this section if there is any evidence of use by wildlife. Evidence of use can be in the plot boundaries or in the ecosystem unit represented by the plot.

13. Species

Indicate the species for which the evidence of use is being recorded. Use the five-letter codes from Cannings and Harcombe (1990), plus additional codes given in Appendix 5.1.

14. Sex

Note the sex of the animal. Code as **M** (male), **F** (female), or **U** (unknown).

15. Life Stage

Record the life stage of the animal using the codes in Table 5.10. Note that these classes differ from those described in the *Standardized Inventory Methodologies for Components of B.C.'s Biodiversity* (Resources Inventory Committee: Elements Working Group 1996).

TABLE 5.10 Codes for life stages for wildlife evidence of use

Code	Life stage	Description
E	Egg	Amphibian, bird, insect, and reptile eggs
N	Nestling	Nestling birds and newly hatched or newborn or neonate newborn amphibians, birds, insects, mammals, and reptiles; only used when it is apparent that the nest site is within the plot type
J	Juvenile	Amphibian larvae, fledged birds before ther first winter, insect larvae, and mammals older than neonates, but still requiring parental care; reptiles do not have a juvenile stage
S	Subadult	Animal that is older than the juvenile stage, does not require parental care, and has not reached sexual maturity; includes amphibians and reptiles which have not reached adult size, but have adult form; insects have no subadult stage
A	Adult	Old enough to breed
U	Undetermined	Old enough to breed

16. Activity

Code up to three different types or signs of activity relevant to the identified species (Table 5.11). If an animal is present in the plot, *or* in the ecosystem unit represented by the plot, record the type of activity it is engaged in on the appropriate section of the form. If there are signs that an animal was present, record the type of activity which caused the signs.

TABLE 5.11 Codes for activities and signs of activity

Code	Activity	Description
AL[a]	Alert	Activity with the purpose of detecting predators; e.g., guard or sentry duty or a heads-up rigid stance
AN[b]	Antler	A cast, solid, annually deciduous horn of a cervid
AP	Avoiding pests	Avoiding pests; e.g., seeing caribou standing on snow fields during summer when insects are abundant
BA	Basking	Behaviour for the purpose of gathering warmth; e.g., a marmot or snake lying on warm rocks, or marmot hair and soiling stains on flat rocks
BE	Bedding	Bedding, sleeping, or resting above ground, including bedding for the purpose of cud chewing, and roosting and resting of birds
BP[b]	Body	Incidental portions of an animal's body which are parts left behind, but do not indicate the ani mal is dead; e.g., feathers, hairs, and shed skins; shed antlers are recorded as "AN"
BU	Building	Building a nest, bed, burrow, den, lodge, or other dwelling
CA	Casting	Discharging bodily waste from the mouth; e.g., an owl or snake casting pellets
CO	Courtship	Behaviour for the purpose of enticing a conspe cific of the opposite sex into copulation, including copulation, courtship feeding, and defense of mates
CR[b]	Carcass	A carcass, or portions of a carcass, that indicates the animal is dead

TABLE 5.11 Codes for activities and signs of activity (continued)

Code	Activity	Description
DE	Denning	Sleeping or hiding in a cavity, cave, or burrow; does not include hibernating; if the same den is used for hibernating and general denning, record as hibernating
DI[a]	Disturbed	Behaviour for the purpose of avoiding the observer; use only if the activity before distur bance is not known
DR[a]	Drinking	Drinking
EX	Excreting	Discharging waste through the anus
FD	Feeding	Consuming food items, including feeding by animals that search for food and eat simultaneously; e.g., grazers, browsers, flying insectivores, and filter feeders; does not include hunting
FL	Fleeing	Hurried movement to avoid conspecifics or other animals; does not include fleeing to avoid the observer
FS	Feeding, salmonid	Feeding on salmonids, during a salmonid run
GR	Grooming	Behaviour for the purpose of arranging and protecting the fur, feathers, skin, etc., including scratching and rubbing of antler velvet
HI	Hibernating	If the same den is used for hibernating and general denning, record as hibernating
HU	Hunting	Searching for, pursuing, and killing prey
IN	Incubation	Incubating, protecting, or laying eggs
LI	Living	Activity could not be specified due to ignorance or the activity was too diverse
MD	Migrating daily	Travelling that is a regular daily activity, including travelling to or away from a communal habitat; e.g., a bat on its daily flight to or from a roosting site

TABLE 5.11 Codes for activities and signs of activity (continued)

Code	Activity	Description
MS	Migrating seasonally	Travelling that is a regular annual activity; e.g., an elk or a Sandhill Crane on its migration route, or a snake travelling away from a communal habitat such as a hibernaculum
RB	Reproducing, birthing	Giving birth to live young; preparing a birthing reproduction site, such as a den
RE	Reproducing, eggs	Laying eggs (amphibians, reptiles and birds), building a nest, and feeding non-mobile young
RR	Rearing	Adults feeding neonates and juveniles
SH	Security habitat	Using habitat for protection or hiding from predators
ST	Security and/or thermal	Using habitat for its security and/or thermal values; used when differentiating between the two values is difficult or impossible
TE	Territoriality	Behaviour for the purpose of marking or defending a territory; e.g., singing, drumming, winnowing, howling, antler rubbing, wallowing, or scraping the ground
TF[a]	Travelling, flying	Used when the purpose of flying is not known; if known, use a more specific description such as hunting
TH	Thermal habitat	Using habitat for protection from heat, cold, or precipitation
TP	Travelling on a path	Walking on a trail that is embedded in the ground due to animals walking the same route for many years
TR	Travelling	Travelling by a method other than flying, swimming, and walking; usually used for animals that do not normally fly, swim, or walk; includes seeing an isolated track; does not include running if the purpose for running is known

TABLE 5.11 Codes for activities and signs of activity (concluded)

Code	Activity	Description
TS[a]	Travelling, swimming	Used when the specific purpose of swimming is not known; if known, use a more specific description such as fleeing
TW	Travelling, walking	Used when the purpose of walking is not known; if known, use a more specific description such as migrating; does not include travelling on a path (see "TP")
UR	Urinating	Urinating

[a] Code is only associated with seeing or hearing an animal
[b] Code is only associated with sign of an animal

17. Descriptor

Enter a coded descriptor (Des) that indicates whether the animal was observed or heard in the plot or ecosystem unit, or gives the probable age or season of the sign (Table 5.12).

TABLE 5.12 Codes for descriptors of wildlife evidence of use

Code	Meaning
S	The animal was seen
H	The animal was heard
F	Fresh sign (<1 week old)
Y	Sign is <1 year old but >1 week old
O	Old (>1 year old)
U	Undetermined (age of sign is unknown)
W	Sign is from the winter season
G	Sign is from the growing season

18. Number

Record the number (No.) of animals present or the number of sign elements. Codes for relative abundance can be used for sign elements instead of numbers (i.e., **H** [high], **M** [moderate], **L** [low], or **T** [trace]).

19. Comments

To provide additional information about the evidence of use, or to clarify an entry on this line on the form, enter a numeric code (Com). Enter the same code in the Comments/Notes section of the form, followed by the pertinent information.

Abbreviated Tree Attributes for Wildlife

The purpose of this section of the form is to provide for a quick assessment of selected tree attributes for wildlife. The data recorded here is abbreviated and more qualitative than that collected using the detailed Tree Attributes for Wildlife Form (Section 6). Refer to Section 6 for information on selecting the sampling method. Once selected, the same sampling method should be used consistently throughout the project.

Also, refer to Section 6 for information on selecting the prism BAF or plot size, and minimum dbh. Once the prism or plot size is determined for the plot, complete appropriate sections of the Wildlife Habitat Assessment Form.

Field Procedures

- Establish plot centre
- Stand at the plot centre and estimate the number of trees in the plot as follows:

  For a variable radius plot do a prism sweep while counting the number of trees in the plot.

  For a fixed area plot stand at the plot centre and while holding arms out at right angles to each other (Figure 5.1) estimate the area and number of trees in one quarter of the plot. Then turn 90 degrees and while holding arms out, repeat the estimate for the second quarter. Do this for all four quarters. Total the values to obtain the number of trees.
- Complete the Abbreviated Tree Attributes for Wildlife portion of the form based upon the trees selected in the step above.

20. Basal Area Factor

If a variable radius plot is used, enter the standard metric Basal Area Factor (BAF) in m^2/ha.

21. Area

If a fixed area plot is used, enter the area of the plot, in m^2.

22. Minimum dbh

Enter the minimum diameter at breast height (Min dbh) being used (in cm).

23. Number of Trees

Record the number of trees (No. of trees) in the variable radius or fixed area plot.

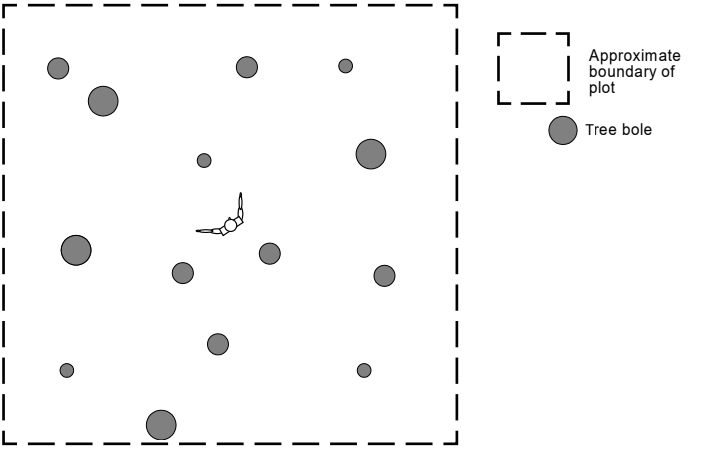


FIGURE 5.1 Top view of biologist standing at centre of plot and estimating the area covering a quarter of the plot and the number of trees in a quarter plot.

24. Number of Dead Trees

Record the number of dead trees (No. dead) in the variable radius or fixed area plot.

25. Number of Live Trees

Record the number of live trees (No. live) in the variable radius or fixed area plot.

26. Average dbh

Visually estimate, and record to the nearest cm, the average diameter at breast height (Avg. dbh) of the trees in the variable radius or fixed area plot.

27. Average Length

Visually estimate, and record to the nearest m, the average length (Avg. length) of the trees in the variable radius or fixed area plot. The estimate must be within 15% of the true average length. A quick and accurate method of estimating tree length is as follows:

- Mark a point 2 m in height from the base of the tree.
- Move away from the tree so that the top of the tree is at an angle of 45°, or less.
- Tilt your head so that by rolling your eyes, and not moving your head, you can see the bottom and top of the tree.

- Hold a piece of twig or grass vertically between your thumb and index finger, and about 20 cm from your face. Adjust the length of the twig so that it spans the 2 m distance marked at the bottom of the tree.
- Move the twig upward vertically, and while rolling your eyes, count the number of twig-lengths that fit between the bottom of the tree and the top. When moving the twig upward it is important to keep the twig vertical and in the same plane, and your head still.
- Multiply the number of twig-lengths by two to obtain the length of the tree, in metres.

28. Average Lichen Loading Class

Visually estimate and record the average lichen loading class (Avg. lich load class) of the wildlife trees in the plot. Assign a rating (**0–5**) based on comparison with photos in *Estimating the Abundance of Arboreal Forage Lichens* (Armleder et al. 1992).

29. Comments

Record observations on tree attributes deemed to be of importance to wildlife.

Simple Coarse Woody Debris Assessment

The purpose of this section of the form is to provide for a quick assessment of total coarse woody debris volume and volume by decay classes following the methods developed by Taylor (1997). The detailed Coarse Woody Debris Form (Section 7) is used both to collect more quantitative data than that collected here and to collect more attributes.

To complete this section of the form, set up a 30 m line transect as follows:

1. Determine plot centre.
2. Establish one 30 m (horizontal distance) line transect following a random azimuth from the plot centre. It is important to measure the slope along the line and determine the slope distance required to produce a horizontal transect of 30 m. If significant slope changes occur along the line, more than one slope distance correction is required.
3. The slope distance factors in Table 4.1 can be used to calculate the required slope distance for a given slope. For example, if the slope is 35%, the slope distance factor is 0.944. The required slope distance is determined by dividing the horizontal distance by the slope distance factor, i.e., 30 m/0.944 = 31.78 m.

30. Sampled __ of 30 m Transect

Indicate the length of the line that was sampled. The form has room to record 22 pieces of CWD. If more than 22 pieces are encountered on a 30 m transect, discontinue the transect and record the number of metres that were sampled to reach 22 pieces. If the entire line was sampled, indicate that all 30 m were sampled.

31. Decay Class

Assign a decay class (1 to 5) based on the majority condition of each piece encountered along the transect. See Table 5.13 for descriptions of classes.

TABLE 5.13 Decay classes for coarse woody debris

	Class 1	Class 2	Class 3	Class 4	Class 5
Wood Texture	Hard	Sap rot (but still hard, thumbnail penetrates)	Advanced decay (spongy/large peices)	Extensive decay (crumbly-mushy)	Small pieces, soft portions
Portion on Ground	Elevated on support points	Elevated but sagging slightly	Sagging or broken	Fully settled on ground	Partly sunken
Branches	Hard branches with twigs	Soft branches	Branches/stubs absent	Absent	Absent
Bark	Firm	Loose	Trace	Absent	Absent
Wood Appearance	Fresh/recent	Colour fading	Fading colour	Light or brown	Reddish brown
Wood strength	Supports person	May not support person	Breaks easily. Pieces snap	Collapses with weight. Pieces do not snap	Feels firm like ground
Invading Roots	None	None	In sapwood	In heartwood	In heartwood

32. Diameter Class

Using the diameter class limits from Table 5.14, record the diameter class (Diam. class) at the point of intersection for each piece encountered along the transect.

TABLE 5.14 Diameter classes for coarse woody debris

Class	Range (cm)	Class	Range (cm)
10	>7.5 – 12.5	**75**	72.6 – 77.5
15	12.6 – 17.5	**80**	77.6 – 82.5
20	17.6 – 22.5	**85**	82.6 – 87.5
25	22.6 – 27.5	**90**	87.6 – 92.5
30	27.6 – 32.5	**95**	92.6 – 97.5
35	32.6 – 37.5	**100**	97.6 – 102.5
40	37.6 – 42.5	**105**	102.6 – 107.5
45	42.6 – 47.5	**110**	107.6 – 112.5
50	47.6 – 52.5	**115**	112.6 – 117.5
55	52.6 – 57.5	**120**	117.6 – 122.5
60	57.6 – 62.5	**125**	122.6 – 127.5
65	62.6 – 67.5	**130**	127.6 – 132.5
70	67.6 – 72.5	**135**	132.6 – 137.5

33. Comments

Record observations of interest or importance to making wildlife interpretations.

Management

This section is to be completed for species or species groups, according to the project objectives, for which specific management prescriptions may be implemented.

If the suitability of a habitat for a particular species (as evaluated in Item 11) is lower than its capability, it may be possible to apply habitat management techniques to achieve the capability of the habitat. Table 5.15 lists management practices of a low technological order (e.g., prescribed burning, livestock control, prescribed logging) that may be possible to prescribe in order to modify certain habitat conditions.

The approach is as follows: considering adjacent habitat features and the current value of the plot for a specific species, use, and season, how could the ecosystem unit represented by the plot be managed to optimize the suitability of the area?

34. Species

From the list of species evaluated on the plot, indicate the species for which the habitat could be managed. Use the five-letter codes as in Item 7.

35. Use

With a two-letter code from Table 5.3, indicate the specified life requisite for which the habitat will be managed. Use additional rows on the form to assess the habitat for more than one habitat use.

36. Season

If required, indicate the season (Ssn) for which the habitat will be managed. Use codes listed in Table 5.4.

37. Food/Cover Life Requisite

Identify the food/cover life requisite (F/C LR), using the codes in Table 5.8, that will be most affected by the management technique described below. If the management technique affects more than one life requisite, then use a combination of codes (e.g., FS indicates that both food and security are affected).

38. Capability

Considering the presence of habitat features, rate the capability (Cap) of the plot to meet the specified use in the specified season for the selected species or species group. Use the codes in Table 5.5. Capability is the ability of the habitat under optimal conditions to provide life requisites for the species.

It is assumed that the management techniques identified below will result in the habitat attaining these optimal conditions.

39. Management Techniques

Identify the management technique(s) (Mgmt. Tech.) from the list in Table 5.15 that would result in the assigned capability.

TABLE 5.15 Codes for management techniques to achieve capability

Code	Management technique
PF	Prescribed fire
MT	Mechanical treatment (slashing/brushing)
PL	Seeding & planting
TS	Thinning & spacing
SC	Selective cutting
CC	Clearcutting
PR	Protection (to maintain current conditions)
GR	Prescribed grazing
NG	No grazing
WL	Water level manipulation
NC	Nest construction
OT	Other

40. Management Feasibility and Intensity

Indicate the feasibility of management or the management intensity (M. Fea/Int) required to fulfill the objectives. Use the codes in Table 5.16.

TABLE 5.16 Management feasibility/intensity codes for identified management techniques

Code	Feasibility/intensity
NR	Not required; habitat is in optimum condition
IM	Impractical; desired changes would take too long
NA	Not appropriate; management would affect the ecosystem
FM	Frequent management required (every 5-10 years)
MM	Moderate management required (every 10-20 years)
IF	Infrequent management required (every 20-50 years)

41. Comments/Notes

Record comments that may assist in developing management prescriptions.

Appendix 5.1
Wildlife Subspecies, Species, and Species Group Codes Not Included in Cannings and Harcombe (1990)

Subspecies codes are derived from the species code; the last letter of the species code is replaced with the first letter of the scientific subspecies name. Species Groups begin the four-letter group code with the letter "U" followed by three letters derived from the common name of the species group. (e.g., unspecified grouse = BUGRU) Species names preceded by an asterisk are in Cannings and Harcombe (1990), and are included here for convenience.

AMPHIBIANS AND REPTILES

Salamanders	**Order Caudata**	
Unspecified Salamander	(unspecified)	A-USAL
Frogs and Toads	**Order Anura**	
Unspecified Frog	(unspecified)	A-UFRO
Turtles	**Order Testudines**	
Unspecified Turtle	(unspecified)	R-UTUR
Lizards	**Order Squamata**	
Unspecified Lizard	(unspecified)	R-ULIZ
Snakes	**Order Serpentes**	
Unspecified Snake	(unspecified)	R-USNA

MAMMALS

Insectivores	**Order Insectivora**	
Unspecified Mole	(unspecified)	M-UMOL
Unspecified Shrew	(unspecified)	M-USHR
Bats	**Order Chiroptera**	
Unspecified Bat	(unspecified)	M-UBAT
Rodents	**Order Rodentia**	
Unspecified Chipmunk	(unspecified)	M-UCHP
Unspecified Jumping Mouse	(unspecified)	M-UJUM
Unspecified Mouse	(unspecified)	M-UMOU
Unspecified Vole	(unspecified)	M-UVOL

Carnivores	**Order Carnivora**	
Black Bear	*Ursus americanus*	M-URAM
Cougar*	*Felis concolor*	M-FECO
Domestic Cat	*Felis sylvestris*	M-FESY
Domestic Dog	*Canis familiarius*	M-CAFA
Fisher*	*Martes pennanti*	M-MAPE
Gray Wolf*	*Canis lupus*	M-CALU
Grizzly Bear*	*Ursus arctos*	M-URAR
Marten*	*Martes americana*	M-MAAM
Unspecified Bear	(unspecified)	M-UBEA
Unspecified Sea Lion	(unspecified)	M-USEL
Unspecified Weasel	(unspecified)	M-UWEA
Ungulates	**Order Artiodactyla**	
Alaska Moose	*Alces alces gigas*	M-ALAG
Bighorn Sheep*	*Ovis canadensis*	M-OVCA
Black-tailed Deer	*Odocoileus hemionus columbianus*	M-ODHC
California Bighorn Sheep	*Ovis canadensis californiana*	M-OVCC
Dall Sheep	*Ovis dalli dalli*	M-OVDD
Elk*	*Cervus elaphus*	M-CEEL
Interior Mule Deer	*Odocoileus hemionus hemionus*	M-ODHH
Moose*	*Alces alces*	M-ALAL
Mule Deer*	*Odocoileus hemionus*	M-ODHE
Northwestern Moose	*Alces alces andersoni*	M-ALAA
Rocky Mountain Bighorn Sheep	*Ovis canadensis canadensis*	M-OVCN
Rocky Mountain Elk	*Cervus elaphus nelsoni*	M-CEEN
Roosevelt Elk	*Cervus elaphus roosevelti*	M-CEER
Sitka Deer	*Odocoileus hemionus sitkensis*	M-ODHS
Stone Sheep	*Ovis dalli stonei*	M-OVDS
Thinhorn Sheep*	*Ovis dalli*	M-OVDA
White-tailed Deer*	*Odocoileus virginiana*	M-ODVI
Yellowstone Moose	*Alces alces shirasi*	M-ALAS
Domestic Cow	*Bos taurus*	M-BOTA
Domestic Goat	*Capra hircus*	M-CAHI
Domestic Horse	*Equus caballus*	M-EQCA
Domestic Pig	*Sus scrofa*	M-SUSC
Unspecified Deer	(unspecified)	M-UDEE
Whales and Porpoises	**Order Cetacea**	
Unspecified Dolphin	(unspecified)	M-UDOL
Unspecified Whale	(unspecified)	M-UWHA

BIRDS

Loons	**Order Gaviiformes**	
Unspecified Loon	(unspecified)	B-ULOO
Grebes	**Order Podicipediformes**	
Unspecified Grebe	(unspecified)	B-UGRE
Albatrosses, Shearwaters and Petrels	**Order Procellariiformes**	
Unspecified Albatross	(unspecified)	B-UALB
Unspecified Shearwater	(unspecified)	B-USHE
Unspecified Storm-Petrel	(unspecified)	B-USTP
Pelicans and Cormorants	**Order Pelecaniformes**	
Unspecified Cormorant	(unspecified)	B-UCOR
Waterfowl	**Order Anseriformes**	
Domestic/feral duck (Peking)	*Anas platyrhynchos*	B-DODU
Domestic/feral goose (Greylag)	*Anser answer*	B-DOGS
Muskovy Duck	*Cairina maschata*	B-MUDU
Unspecified Dabbling Duck	(unspecified)	B-UDAD
Unspecified Diving Duck	(unspecified)	B-UDID
Unspecified Goldeneye	(unspecified)	B-UGOL
Unspecified Merganser	(unspecified)	B-UMER
Unspecified Scaup	(unspecified)	B-USCA
Unspecified Scoter	(unspecified)	B-USCO
Unspecified Swan	(unspecified)	B-USWN
Unspecified Teal	(unspecified)	B-UTEA
Vultures, Hawks, and Falcons	**Order Falconiformes**	
Unspecified Eagle	(unspecified)	B-UEAG
Unspecified Falcon	(unspecified)	B-UFAL
Unspecified Hawk	(unspecified)	B-UHAW
Gallinaceous Birds	**Order Galliformes**	
Unspecified Grouse	(unspecified)	B-UGRU
Unspecified Ptarmigan	(unspecified)	B-UPTA
Shorebirds, Gulls, Auks, and Allies	**Order Charadriiformes**	
Unspecified Auklet	(unspecified)	B-UAUK
Unspecified Gull	(unspecified)	B-UGUL
Unspecified Murre	(unspecified)	B-UMUR
Unspecified Murrelet	(unspecified)	B-UMUL
Unspecified Puffin	(unspecified)	B-UPUF
Unspecified Shorebird	(unspecified)	B-USHO
Pigeons and Doves	**Order Columbiformes**	
Unspecified Dove	(unspecified)	B-UDOV

Owls	**Order Strigiformes**	
Unspecified Owl	(unspecified)	B-UOWL
Swifts and Hummingbirds	**Order Caprimulgiformes**	
Unspecified Hummingbird	(unspecified)	B-UHUM
Unspecified Swift	(unspecified)	B-USWI
Woodpeckers	**Order Piciformes**	
Unspecified Woodpecker	(unspecified)	B-UWOO
Passerine Birds	**Order Passeriformes**	
Unspecified Blackbird	(unspecified)	B-UBLA
Unspecified Bluebird	(unspecified)	B-UBLU
Unspecified Chickadee	(unspecified)	B-UCHI
Unspecified Crossbill	(unspecified)	B-UCRO
Unspecified Finch	(unspecified)	B-UFIN
Unspecified Flycatcher	(unspecified)	B-UFLY
Unspecified Grosbeak	(unspecified)	B-UGRO
Unspecified Kinglet	(unspecified)	B-UKIN
Unspecified Longspur	(unspecified)	B-ULON
Unspecified Nuthatch	(unspecified)	B-UNUT
Unspecified Redpoll	(unspecified)	B-URED
Unspecified Shrike	(unspecified)	B-USHI
Unspecified Sparrow	(unspecified)	B-USPA
Unspecified Swallow	(unspecified)	B-USWA
Unspecified Thrush	(unspecified)	B-UTHR
Unspecified Vireo	(unspecified)	B-UVIR
Unspecified Warbler	(unspecified)	B-UWAR
Unspecified Waxwing	(unspecified)	B-UWAX
Unspecified Wren	(unspecified)	B-UWRE

6 TREE ATTRIBUTES FOR WILDLIFE

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Tables

Figures

BRITISH COLUMBIA

TREE ATTRIBUTES FOR WILDLIFE

Project id. (1) | Plot no. (4) | Surveyor (3)

B.A.F (m^2/ha) (5) | Plot size (m^2) (6) | Minimum DBH (cm) (7) | Date y (2) m d

Tree No.	Species	Stand/Fall	DBH (cm)	M or E	Rem. Bark (%)	Length: Top (%)	Length: Bot (%)	Length: Bot pos (m)	Length: Slope Distance (m)	Estimated length (m)	Cr. Class		Wildlife Codes: Appear	Crown	Bark	Wood	Lichen	Wildlife use
0 1																		
0 2	(8)	(9)	(10)	(11)	(12)				(13)	(14)	(15)	(16)				(17)		
0 3																		
0 4																		
0																		
0																		
0 7																		
0 8																		
0																		
1																		
1 1																		
1 2																		
1 3																		
4																		
1 5																		
1 6																		
1 7																		
1 8																		
1 9																		
2 0																		

Comments

FS882 (6) HRE 2008/03

Field Procedure

Getting Started

1. Identify sample trees based on a prism sweep, or if using a fixed-area plot, establish plot boundaries. Be aware of the minimum dbh for the project.
2. If desired, tag or flag numbers on each tree including all live and dead, standing and fallen trees.

Measure and Record

1. Enter the header information.
2. For each sample tree, record the species and classify as standing or fallen.
3. Determine dbh and percentage of bark remaining at breast height.
4. Record data required to calculate the length of each sample tree, or estimate length.
5. For each standing live tree, assign a crown class and determine height to live crown.
6. For each sample tree, assess appearance, crown condition, bark retention, wood condition, lichen loading, and wildlife use.
7. Check that all the required information has been collected and noted on the form. Strike through any fields that were not assessed.

Selecting the Sampling Method

Either a fixed-area or variable-radius plot may be used. Variable-radius plots will be used most commonly, but if the project area is dominated by stands with the following characteristics, a fixed-area plot may be preferable:

- very open stands with widely spaced trees or clumps of trees
- very dense stands where not all trees in a plot would be easily visible

Once selected, the same plot-type should be used consistently throughout the project.

Selecting the Minimum Diameter

The minimum diameter at breast height (dbh) is determined by the wildlife species of concern in the project—the goal is to sample a reasonable number of trees of an appropriate minimum size for the species. For example, for Bald Eagle interpretations, trees less than 20 cm dbh are not of value and may be ignored. For most projects, the minimum dbh will be 15 cm or greater. Trees less than the minimum dbh are ignored

Selecting a Basal Area Factor Prism

The basal area factor (BAF) prism size should be based on previous experience. A prism size that will provide 7-11 sample trees (greater than or equal to the minimum dbh) per plot is ideal. A minimum of 5 and maximum of 16 trees is required. Generally, the larger the trees, the larger the BAF; the denser the stand, the smaller the BAF required. It may be necessary to have several prisms available throughout a project. When traversing the stand, but before determining the plot location, the prism size should be selected.

Selecting the Plot Size and Shape

For fixed-area plot sampling, a plot size is selected that will provide ten or more sample trees greater than or equal to the minimum dbh. The plot size is determined for a project and is only reduced or increased in exceptional circumstances. The decision of whether to increase or decease, e.g., double or halve, the plot size is done when entering the stand, before the plot is marked, so as to minimize bias.

Plot shape can be circular, square, or rectangular, but should be determined at the start of a project.

Completing the Form

Numbered items below refer to circled numbers on the Tree Attributes for Wildlife Form shown at the beginning of this section. A recommended sequence for completing the form is described under "Field Procedure."

1. Project Identification
Identify the project (Proj id.) as in Item 3, Site Description Form.

2. Date
Enter the 2-digit codes for year, month, and day.

3. Surveyor
Enter the first initial and last name of person(s) collecting tree attribute data.

4. Plot no.
Record the plot number from the Site Description Form.

5. Basal Area Factor
Enter the standard metric (m^2/ha) Basal Area Factor (BAF) prism used, if applicable.

6. Plot size
Enter the area of the plot, if applicable.

7. Minimum Diameter
Enter the minimum diameter (dbh) being used.

8. Species
Identify tree species using the codes given in Keys and Codes (section 9).

9. Standing / Fallen
Classify the tree as standing or fallen using the following codes and criteria:

S **Standing** Trees or portions of trees with the root attached and self-supporting (i.e., the tree would remain standing if all supporting materials were removed).

F **Fallen** Trees or portions of trees with the root attached and not self-supporting, greater than 1.3 m in length.

10. Diameter at Breast Height

Measure the diameter at breast height (dbh), i.e., 1.3 m, of all live, dead, standing, and fallen sample trees.

- On slopes, breast height is measured from the high side of the tree.
- Measure diameter to the nearest 0.1 cm.
- Hold the diameter tape tight, making no allowance for missing bark.
- If it is not possible to measure dbh accurately because of an obstruction or unsafe conditions, enter an estimate.

11. Measured or Estimated

If it was necessary to estimate dbh, enter **E**; otherwise, enter **M**.

12. Remaining Bark

Record, to the nearest percent, the percentage of bark remaining at breast height. Use the diameter tape to measure the total circumference and the portion of the circumference with bark remaining. The ratio of the two numbers multiplied by 100 equals the percent remaining bark. For example, if a tree with a 60 cm circumference has bark remaining on 15 cm, the percent remaining is $15 \div 60 \times 100 = 25\%$. Note the following coding convention:

- Record 100% bark remaining as "– –". When the data is entered into a database, e.g., VENUS, substitute 100 for "– –".
- If no bark is present, record as "00".

13. Length

Determine the total length of all trees greater than 1.3 m high by collecting all the information required to complete the fields on the form. Measure length from the ground surface on the high side of the stem, along the stem, to the top.

- If the tree is broken, record the length of the stem to the point of breakage.
- On fallen trees, measure from the root collar to the top of the last attached portion of the stem.
- Length may be estimated if it is not possible to measure accurately because of obstructions, unsafe conditions, or if project objectives do not require measured accuracy on all trees.

Slope to top of tree (Top):
Enter the percent slope to the top of the tree; the sign must be shown (usually '+'). The maximum acceptable reading is 99%. If a reading greater than 99 is obtained, move further from the tree, or up slope.

Slope to DBH or bottom of tree (Bot):
Enter the percent reading to dbh, or the base of the tree, or to the lowest visible point; the sign must be shown ('+' or '-'). The maximum allowed reading is 99%.

Bottom position (Bot pos):
Enter, to the nearest 0.1 m, the height at which the **Bot %** reading was taken.

Slope distance (SD):
Enter the distance, to nearest 0.1 m, from the observers eye to the centre of the tree trunk at **Bot pos**.

The above information is used by the data entry program, VENUS, to calculate the length of each tree. The equation used is: Height = **Bot pos** + (**Top** - **Bot**)/100 × (SD × cos(arctan(abs(**Bot**/100)))).

14. Estimated Length

If estimating length, enter to the nearest metre. Project objectives may allow for some lengths to be estimated in order to speed-up the field work. Use conventions as in Item 13. Note: If measuring length, the data entry program, VENUS, will calculate the length from the information in Item 13.

15. Crown Class

Assign a crown class designation to all standing live trees as follows:

D **Dominant** Trees with crown extending above the general level of the layer; somewhat taller than the codominant trees, and have well developed crowns, which may be somewhat crowded on the sides.

C **Codominant** Trees with crowns forming the general level of the crown canopy; crown is generally smaller than those of the dominant trees and usually more crowded on the sides.

I **Intermediate** Trees with crowns below, but extending into the general level of the crown canopy; crowns usually small and quite crowded on the sides.

S **Suppressed** Trees with crowns entirely below the general level of the crown canopy.

16. Height to Live Crown

For each live tree, measure height to live crown (effective portion of the live crown for growth) in metres. This is normally the height on the stem at which live branches occupy about three-quarters of the stem circumference. Enter negative one (-1) for trees with no "effective" crown (e.g., only a few green branches).

17. Wildlife Codes

Each tree sampled is classified according to the following criteria and the appropriate code is entered on the field form.

Appearance (Appear):
For each tree, enter a code (1–9) for the illustration in Figure 6.1 that best represents the appearance of the tree, using the shape of the tree stem as the dominant characteristic.

Crown condition (Crown):
Using one of the classes in Table 6.1, rate the condition of the crown in relation to a normal live crown. Note: lower crown loss due to self-pruning is not counted as foliage or branch loss.

TABLE 6.1. Crown condition codes

Code	Description
1	All foliage, twigs, and branches present
2	Some or all foliage lost; possibly some twigs lost; all branches usually present; possible broken top
3	No foliage present; up to 50% of twigs lost; most branches present; possible broken top
4	No foliage or twigs present; up to 50% of branches lost; top usually broken
5	Most branches gone; some sound branch stubs remain; top broken
6	No branches present; some sound and rotting branch stubs, top broken

Bark retention (Bark):
Indicate the proportion of bark remaining on each tree, using the codes in Table 6.2.

TABLE 6.2. Bark retention codes

Code	Description
1	All bark present
2	Bark lost on damaged areas only (< 5% lost)
3	Most bark present; bare patches; some bark may be loose (5–25% lost)
4	Bare sections; firm and loose bark remains (26–50% lost)
5	Most bark gone; firm and loose bark remains (51–75% lost)
6	Trace of bark remains (76–99% lost)
7	No bark (100% lost)

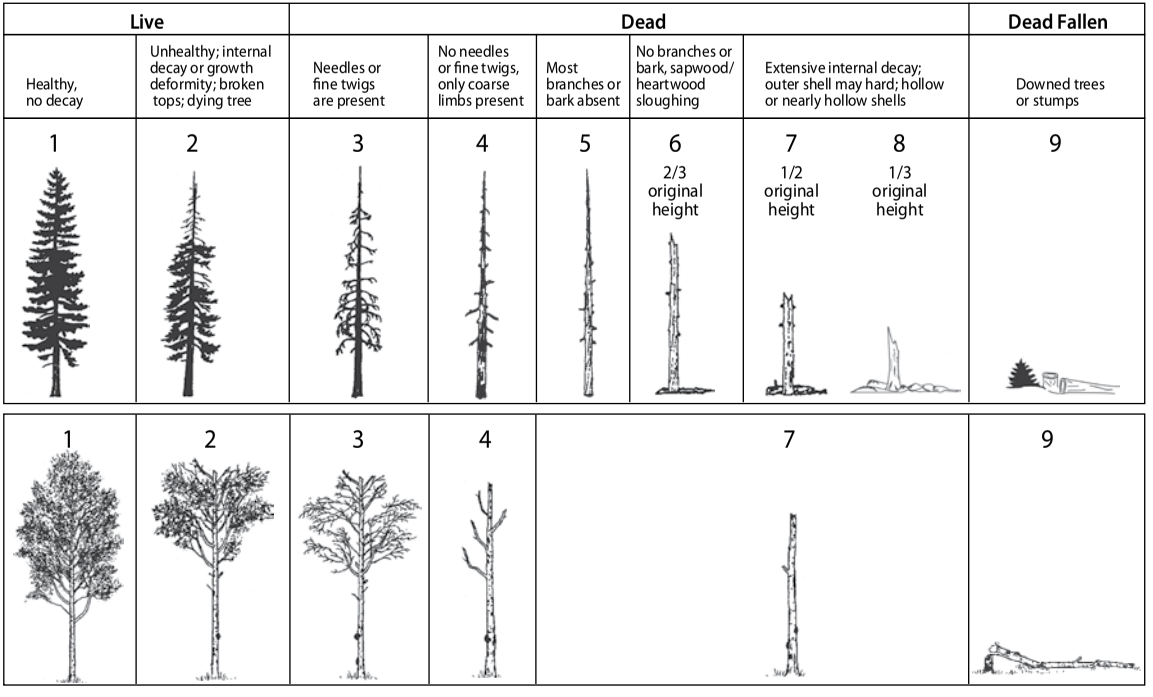


FIGURE 6.1 Visual appearance codes for wildlife trees.

Wood condition (Wood):
Classify the texture (soundness) of the wood for each tree, using the codes in Table 6.3.

TABLE 6.3 Wood condition codes

Code	Description
1	No decay
2	Probable limited internal decay and/or deformities
3	Wood essentially hard; limited decay
4	Wood mostly hard, but decay spreading; soft wood present
5	Balance of hard and soft wood; spongy sections
6	More soft and spongy wood than hard wood
7	No more hard wood; all soft or spongy; powdery sections
8	Hollow shell; outer wood mostly hard or firm

Lichen loading (Lichen):
Assess all standing live or dead trees for lichen loading on branches that are within 4.5 m of the ground or root collar. Assign a rating (**0–5**) based on comparison with photos in *Estimating the Abundance of Arboreal Forage Lichens* (Armleder et al. 1992). A value of 0 indicates no lichens, whether it is a live tree with branches and foliage or a dead tree. If a tree has lichens but none are below the 4.5 m mark, rate as zero.

Wildlife use:
If wildlife are observed using sample trees or if there is evidence of use, record a code for the type of use (activity) in the first column and the user in the second column (e.g., a feeding bird [FB], nesting amphibian [NA], denning mammal [DM]). If only the activity can be determined, leave the second column blank. If no evidence of wildlife use is observed, indicate with dashes (--).

Activity:

C Cavity nest May be difficult to detect, but locations are somewhat predictable, and in season, the begging calls of nestlings are easy to detect; test a tree with a cavity nest by carefully striking it to determine if the nest is occupied; if possible, note species in the *Comments* section using the specific species code (see section "User" below).

- Many woodpeckers prefer nesting in live hardwoods, often underneath branches.
- Nuthatches and chickadees nest in broken-off standing dead trees, or in broken branch holes, often directly below the breakage point where stem rots have entered the tree and softened the heartwood.
- Cavity nesters have perfectly round or oval nest holes.

- The Pileated Woodpecker and the Common Flicker have oval nest holes.
- Downy Woodpeckers, Chickadees, and Nuthatches have small round nest holes.
- Brown Creepers have hammock nests under the loose bark.
- Some ducks, owls, and squirrels nest in abandoned woodpecker holes.

O **Open nest** Nests of eagles, hawks, owls, and herons are usually situated in the upper part or crown of live and dead trees; raptors and herons build large platform-style stick nests.

D **Denning/resting** May be used by bears, squirrels, bats, marten, fisher, weasels, skunks, and raccoons.

- Bears often hibernate in the hollow trunks of large standing trees, especially western redcedars.
- Entrances to tree dens can be basal or arboreal.

F **Feeding** Some examples of indicators are:

- Pileated Woodpeckers excavate large rectangular feeding holes.
- Red-breasted and Yellow-bellied Sapsuckers drill horizontal patterns of sap wells.
- Three-toed and Black-backed Woodpeckers scale off bark to feed on insects.
- Porcupines gnaw on large sections of bark (diagonal tooth marks are often apparent).
- Rabbits, hares, and squirrels feed on the base of young trees (squarish "windows" or girdling at the base).
- Squirrels cache cones or leave basal accumulations of cone bracts.

M **Mark tree** Trees used mostly for communication of territorial boundaries and during courtship; examples of indicators include claw marks by grizzly or black bears, and antler rubbing by deer or elk.

P **Perching/roosting** Some examples of indicators are:

- Perch trees of aerial foraging and hawking birds are typically tall, with prominent dead branches which provide a good view of the surrounding area; especially common near riparian edges.
- Plucking spots where raptors feed are identified by "whitewash" and remains of prey in the vicinity.
- Roost trees are often in sheltered locations with natural or excavated cavities; roosting sites include cavities, hollows, beneath bark, and in foliage.

S Squirrel cache

User:
If possible, enter a code identifying the user, as follows:

M = mammal
B = bird
R = reptile
A = amphibian

If a wildlife species using a sample tree can be positively identified, record the species code on the Wildlife Habitat Assessment form or record it in the NOTES section of the Site Description Form. Use the six-character codes found in Appendix 5.1. The first letter identifies the species as mammal **(M)**, bird **(B)**, reptile **(R)** or amphibian **(A)**; the remaining 4 letters are from the first two letters each of the genus and species names, or of the common names (mostly in the case of birds).

7 COARSE WOODY DEBRIS

Contents

BRITISH COLUMBIA

Date y (2) m d

Plot no. (1)

Surveyor (3)

COARSE WOODY DEBRIS

Transect #1

Azimuth (4) (0–359) Sampled (5) of 24 m

Tree No.	Species (6)	Diameter (cm) (7)	Class (8)	Tilt Angle (9)	Length (m) (10)	Height of end (cm) (11)	Angle grnd. (12)
01							
02							
03							
04							
05							
06							
07							
08							
09							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Transect #2

Azimuth (0–359) Sampled of 24 m

Species	Class	Tilt Angle	Length (m)	Angle grnd.

Degree and Type of Piling (in plot boundaries)

Pile #	Size of pile (m) length (13)	width	height	Diam (cm)	Inter. spac.
1					
2					
3					
5					
6					
7					
8					

Comments

Field Procedure

Getting Started

1. The materials required for sampling coarse woody debris (CWD) are:
   - a compass, graduated in degrees;
   - a clinometer, in percent and degrees (the latter read through the side window);
   - slope correction tables or trigonometry formulas;
   - two measuring tapes (minimum of 30 m each);
   - a metric carpenters tape;
   - a diameter tape and/or calipers;
   - notebook with forms, pencil.
2. Establish the first sampling line by following a random azimuth for that plot.
   - Measure out a 24-m line from the plot centre, correcting the slope distance to horizontal by using slope tables or trigonometry.
   - Anchor the tape at both ends of the line.
3. Establish the second sampling line at plus 90° from the first line by following the same procedures in (2) above.
4. Record the azimuth of each line.

Measure and Record

1. Note the length of each line sampled out of the total. The full length of one or both lines may not be sampled because of unsafe conditions or heavy accumulations of CWD. Otherwise they will be 24 out of 24 m.
2. Walk out along the first sampling line and select the pieces of CWD to be measured according to the sampling rules. Take care not to trample and crush the CWD as you walk along the line.

   As each piece that fits the definition of CWD is encountered, note the following:
   - tree species to the level that is reliable,
   - diameter,
   - decay class, based on the entire piece, by using the table of decay class indicators,
   - tilt angle of each piece, and
   - length of each piece, measured or estimated.
3. Where CWD pieces are suspended above the sampling line it may be necessary to estimate certain attributes (diameter and/or length).
4. If odd-shaped pieces are encountered, use the rectangular method by record their diagonal length at intersection and width (ground to height of piece) (Marshal et. al 2000).
5. Repeat steps 2, 3, and 4 for the second transect line.

6. Check the form to ensure all the required information has been collected. Strike through any fields that were not assessed.

Definition of Coarse Woody Debris

Coarse woody debris (CWD) is dead woody material, in various stages of decomposition, located above the soil, larger than 7.5 cm in diameter (or equivalent cross-section) at the crossing point, which is not self-supporting. Trees and stumps (intact in ground) are considered self-supporting.

Pieces of coarse woody debris may be suspended on nearby live or dead trees, other pieces of coarse woody debris, stumps or other terrain features.

Coarse woody debris includes:

- downed horizontal or suspended (not self-supporting) dead tree boles with or without roots attached;
- fallen trees which still have green foliage if they no longer have roots attached (no living cambium) to the ground to keep them alive;
- woody pieces greater than 7.5 cm at the point where the sampling line crosses the piece;
- trees suspended on other trees if they are not self-supporting;
- uprooted (not self-supporting) stumps greater than 7.5 cm in diameter at the crossing point and any of their exposed dead roots greater than 7.5 cm in diameter at the crossing point;
- fallen broken tree tops which may be horizontal or leaning, or large fallen branches; and,
- recently cut logs.

Coarse woody debris does not include:

- dead branches still connected to standing trees;
- self-supporting (not overturned) stumps;
- exposed roots of self-supporting trees or stumps;
- live or dead trees (still rooted) which are self supporting; and,
- "Ghost CWD" — material that is buried beneath organic or mineral soil layers or has decomposed enough to be part of the forest floor.

  Ghost CWD is older than Class 5. Some of the distinguishing characteristics are:

  – the wood is soft throughout, easily crushed in the hand, and decomposed enough to be considered forest floor humus;

- the piece is well sunken and covered by moss and litter, just above the general level of the forest floor (Be careful to check this. On some slopes forest floor debris can build up around the edges of a piece, giving the impression that it has become part of the ground); and,
- the shape of the piece (or the overlying carpet of moss and forest floor is a continuous, gradually sloped ridge without vertical edges.

Sampling Methods

Sample coarse woody debris along two 24 m (horizontal distance) lines. These should run from the plot centre, the first following a random azimuth and the second at plus 90° to the azimuth. Take the slope of each line and determine the slope distance required to produce a horizontal line of 24 m length. If for any reason all of the line cannot be sampled, note the distance which was actually sampled out of the total distance (record in comments section why the portion was not measured).

If the line falls on *heavy* accumulations such as windthrow, felled and bucked timber, or logging debris and the random azimuth is odd, sample only the first and third quarters of the line (from 0 to 6 m and from 12 to 18 m). If the random azimuth is even, sample the second and fourth quarters of the line (from 6 to 12 m and from 18 to 24 m).

If the line falls on *very heavy* accumulations of windthrown, felled and bucked timber, or a debris pile, sample only the second quarter of the line (from 6 to 12 m) for even random azimuths and the third quarter (12 to 18 m) for odd random azimuths. An estimate should be made of the number of pieces and their diameters in heavy accumulations which can not be safely or accurately measured.

Coarse woody debris in the form of felled and bucked logs, or cold decks, is sampled even though this material will likely be removed.

When non-linear pieces are encountered, an equivalent diameter is recorded. This applies to chunks with odd configurations.

Rules for Sampling

If the transect crosses coarse woody debris, measure the amount above the soil at the crossing point. Some of the CWD may be suspended above the transect line. In such cases it might be necessary to estimate diameter and length measurements.

- Coarse woody debris must be greater than 7.5 cm in diameter (or equivalent) at the line intersect point (see 7.1a).

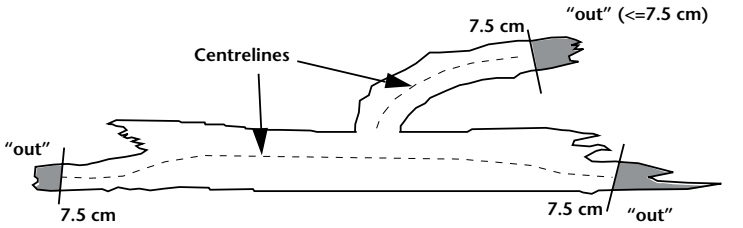


FIGURE 7.1a

- The transect must cross the central axis of the piece (see 7.1b).

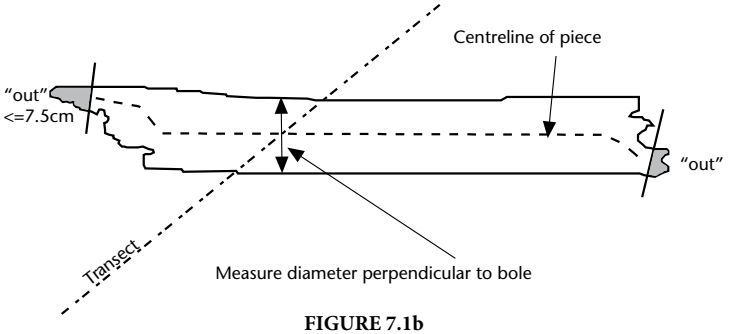


FIGURE 7.1b

- If the transect coincides closely with the centreline, make the best decision as to whether the line crosses the centreline, and where (see 7.1c).

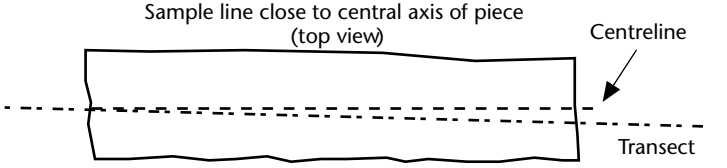


FIGURE 7.1c

- If the transect intersects a curved or angular piece more than once, measure each intersection as a separate observation (see 7.1d).

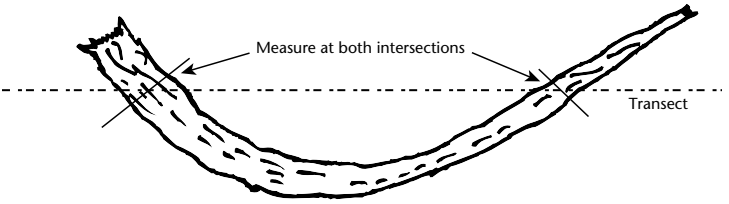


FIGURE 7.1d

FIGURE 7.1. Rules for sampling coarse woody debris.

- If a log has split open, but is still partially held together, record the diameter as if the piece were whole. If a stem has shattered into a number of distinct, unconnected pieces, record each piece that is greater than 7.5 cm in diameter at the point of sampling.
- Do not tally undisturbed stumps. Tally uprooted stumps and their exposed dead roots if they meet the other criteria.
- Tally only the CWD that lies above the soil (see 7.2). A piece is no longer above the soil when it is entirely buried beneath a layer of surface organic matter (forest floor) and/or mineral soil. Estimate an "equivalent" diameter for the remaining portion of logs where part of the wood has decayed and become part of the soil layer.

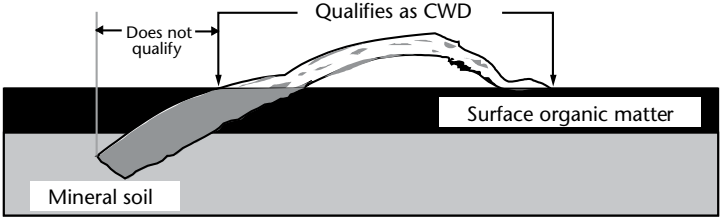


FIGURE 7.2 Tally only coarse woody debris that lies above the soil.

Completing the Form

Numbered items below refer to circled numbers on the Coarse Woody Debris (CWD) Form shown at the beginning of this section. A recommended sequence for completing the form is described in "Field Procedure."

1. Plot Number
Record the plot number and the project identification (Proj. id.) from the top of the Site Description Form.

2. Date
Enter the year (YY), month (MM), and day (DD).

3. Surveyor
Enter the first initial and last name of the person(s) collecting CWD data (Survyr).

4. Azimuth
Record the first azimuth (randomly selected) for Transect No. 1, and the second at plus 90º to Transect No. 2.

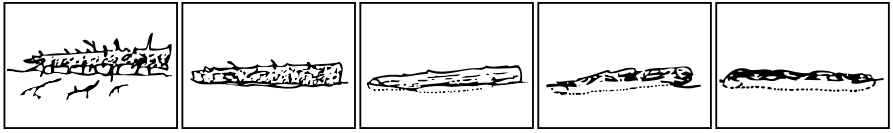
5. Line Length
Record the distance that was actually sampled (Sampled ___ of 24 m) out of the total distance, in the spaces provided.

6. Species
Record code for each piece, using tree species codes found in Keys and Codes 9.20. If the species can not be determined put "X" for unknown, "Xh" for unknown hardwood, or "Xc" for unknown conifer.

7. Diameter
Record the diameter of the piece perpendicular to the bole at the point where the sampling line is considered to intersect the central axis of the piece. Wrap a diameter tape around the bole, when possible, or use the reverse side of the tape to estimate the diameter. Calipers may also be used, and are often easier when coarse woody debris is in several layers. Measure diameter to the closest 0.1 cm. If the CWD is hollow, estimate the diameter equivalent required to approximate the volume of the remaining wood.

8. Class
Assign a decay class (1 to 5) based on the majority condition of the entire piece. The five classes used to describe the condition of coarse woody debris are based primarily upon wood texture, and secondarily on other characteristics. See Table 7.1 for descriptions of classes.

TABLE 7.1 Decay classes for coarse woody debris



	Class 1	Class 2	Class 3	Class 4	Class 5
Wood Texture	Hard	Sap rot (but still hard, thumbnail penetrates)	Advanced decay (spongy/large peices)	Extensive decay (crumbly-mushy)	Small pieces, soft portions
Portion on Ground	Elevated on support points	Elevated but sagging slightly	Sagging or broken	Fully settled on ground	Partly sunken
Branches	Hard branches with twigs	Soft branches	Branches/stubs absent	Absent	Absent
Bark	Firm	Loose	Trace	Absent	Absent
Wood Appearance	Fresh/recent	Colour fading	Fading colour	Light or brown	Reddish brown
Wood strength	Supports person	May not support person	Breaks easily. Pieces snap	Collapses with weight. Pieces do not snap	Feels firm like ground
Invading Roots	None	None	In sapwood	In heartwood	In heartwood

9. Tilt Angle

Refers to the tilt of the individual log away from the horizontal, regardless of the slope of the ground. A clinometer is placed on the surface of the piece at the point of the intercept measurement and the angle from the horizontal (in degrees) is recorded (see FIGURE 7.3).

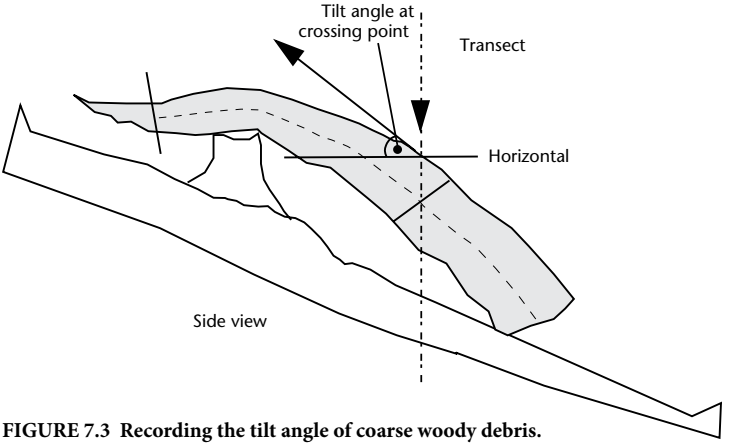


FIGURE 7.3 Recording the tilt angle of coarse woody debris.

10. Length

Record the length of each piece to the nearest 0.1 m (see 7.4a).

- If a log has broken lengthwise but is still partially held together, record the equivalent length as if the piece were whole.
- If the end(s) of the piece are broken, visually fold in the broken sections to compensate for the missing parts.
- Piece length is from the largest end down to the 7.5 cm diameter limit.

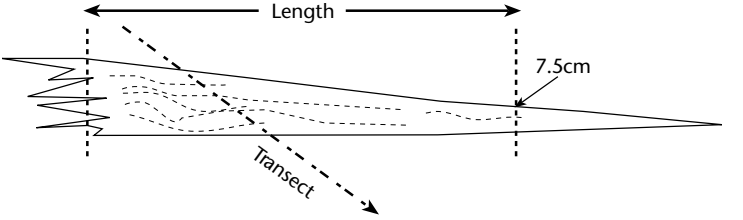


FIGURE 7.4a

Measurement of stems from attached roots:

- For main boles with exposed roots, piece length is measured only down to the root collar (see 7.4b).

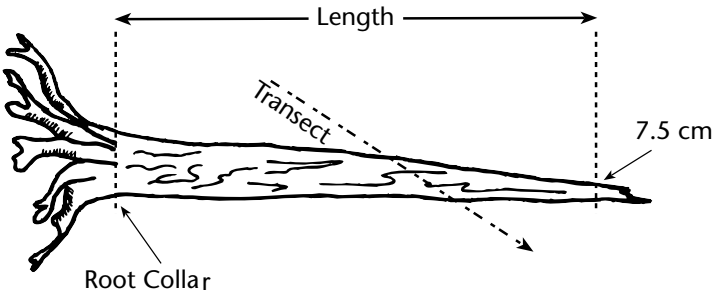


FIGURE 7.4b

- If a root mass is transected, piece length for individual roots (larger than the minimum diameter) is measured only up to the root collar (see 7.4c).

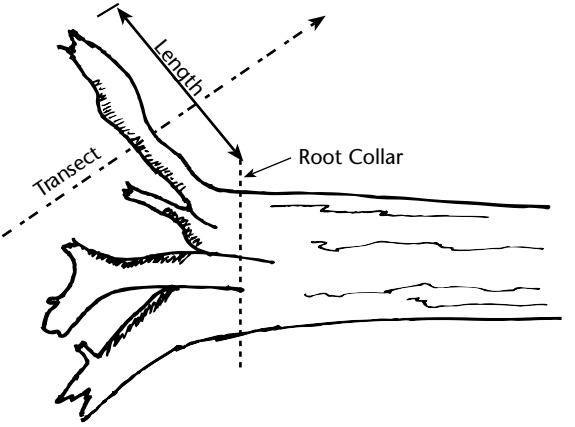


FIGURE 7.4c

Measurement of forked stems:

- Where one of the forks transected is determined (by largest diameter) to be a continuation of the main bole then the length will be measured to the ends of the main piece (see 7.4d).

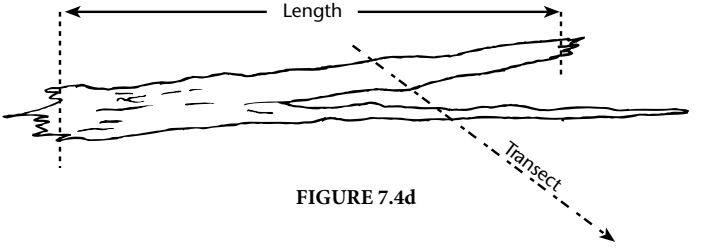


FIGURE 7.4d

- The piece length of the smaller stem(s) (smaller diameter) will be measured only to the junction with the main bole (see 6.7e).

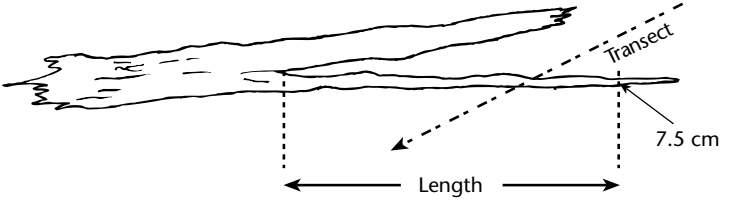


FIGURE 7.4e

- For forks of near equal stature make a determination as above and measure accordingly.

Measurement of pieces that are crossed more than once on the transect:

- Pieces broken but still physically attached are measured as one piece at each transect point.The length measurement is taken along the central axis of the piece (see 7.4f).

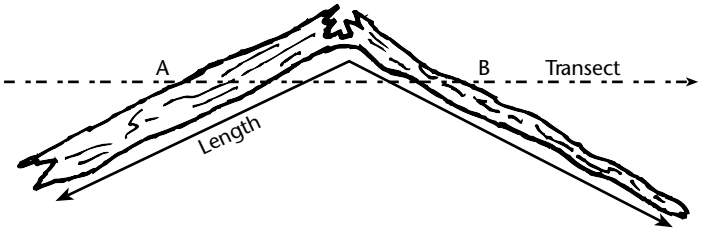


FIGURE 7.4f

- The full piece length of curved/crooked pieces is measured at both crossings (see 7.4g).

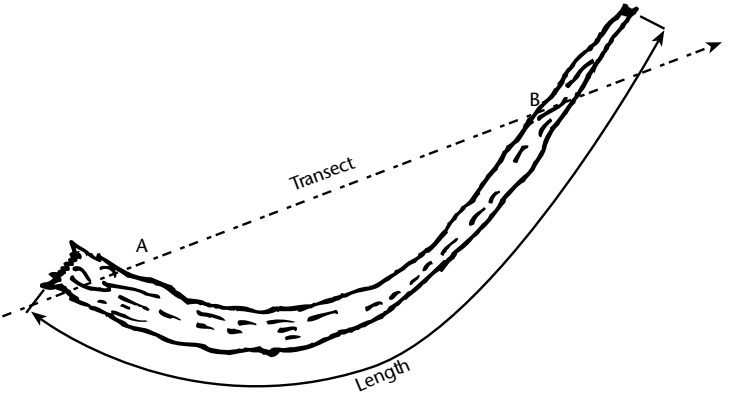


FIGURE 7.4g

FIGURE 7.4 Rules for measuring length of coarse woody debris.

In the same manner as above, record the full piece length twice where the same piece is crossed by two transects at right angles to each other.

11. Height of Lowest End

This is the height above ground of the central axis of the lowest end of each piece of CWD, measured to the nearest cm. The lowest end is defined as the end of the piece that is in closest contact with the ground, not necessarily the end that is at the lowest altitude.

12. Angle of Ground

At the transect crossing measure and record the angle of the ground, following the same procedure for determining CWD piece tilt. It may be neccessary to measure the ground angle over a 1 to 2 m (or more) distance if the surface is irregular.

Record this angle to the nearest degree and indicate whether it is positive or negative (e.g. -07, +12). When measuring the angle of the ground, face in the direction that gives a positive tilt angle for the piece of CWD. The angle of ground measured by sighting in that direction may be positive or negative.

13. Degree and Type of Piling

Piles of CWD are important for many wildlife species. Use of the pile is dependent upon interstitial spaces as well as the diameter of pieces and the size of the pile.

Size of pile:
Record the estimated length, width, and height to nearest 0.1 m.

Diameter:
Record, to nearest cm, the average diameter of pieces of CWD composing the pile.

Interstitial Spaces:
Using the codes in Table 7.2, estimate of the size of interstitial spaces. This not intended to indicate which species will use the pile.

TABLE 7.2. Codes for size of interstitial spaces

Code	Class	Description
s	small	Most interstitial spaces are the size of, or smaller than, a squirrel
m	medium	Most interstitial spaces are the size of a lynx
l	large	Most interstitial spaces are the size of, or larger than, the average black bear

8 SITE VISIT STANDARDS

Contents

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SITE VISIT FORM

PROJEC T ID (1)

Plot No. (2) | Plot Type: Grnd ☐ Visual ☐ (3) Note ☐ Other ☐ | Date (4) Y - MM - DD

Surveyors (5) | Map Polygon No. (6) | Plot Photo (7)

Plot Location (8)

FS Region/ District (9) | East | North (11) | UTM Zone

NTS Map. (10) | Lat. | Lg. | Accu r. (+/- m) (12)

Plot Representing (13)

BGC (14) | SS (15) | SMR (16) | SNR (17) | Map Label (18)

Site Features | Ele vation (19) | Slope % (20) | Aspect (21) | Surface Shape ST ☐ C ☐ (22) CV ☐

Crest ☐ (23) pper ☐ Mid ☐ Lower ☐ Toe ☐ Level ☐ Dep. ☐ Gully ☐ Flood Plain? ☐

Expose. Type ☐ n/a (24) ☐ insolation ☐ frost ☐ wind ☐ cold air ☐ snow ☐ salt spray ☐ water spray ☐ air toxicity ☐ misc. _____

Site Disturb. ☐ n/a (25) ☐ fire ☐ harvest ☐ site prep. ☐ planted ☐ terrain ☐ biotic ☐ soil dist. _____ ☐ other _____

Stand Attributes | Stand Age (26) _____ Est. Mea. ☐ | Stand Ht. (27) _____ Est. Mea. ☐ | Canopy Composition (28)

Struct. Stage (29): 1a ☐ 1b ☐ 2a ☐ 2b ☐ 2c ☐ 2d ☐ 3a ☐ 3b ☐ 4 ☐ 5 ☐ 6 ☐ 7a ☐ 7b ☐

Success Status (30): NV ☐ PS ☐ YS ☐ MS ☐ OS ☐ YC ☐ MC ☐ OC ☐ DC ☐

Terrain	Texture	Surficial Material	S. Expression	Geo. Process	Rock Types
1	(31)				1
2					2 (32)

Rooting Zone | Drainage (33) X ☐ R ☐ W ☐ M ☐ I ☐ P ☐ V ☐

Humus/Organic Form (34) Mor ☐ Moder ☐ Mull ☐ Fibric ☐ Mesic ☐ Humic ☐

Humus Thickness _____ (35) cm | Ah? ☐ Ae? ☐ _____ (36) cm | Estimated Soil Depth _____ (37) cm

R.Z. Soil Texture _____ (38) | R.Z.Coarse Fragrament % _____ (39) | Estimated Rooting Depth _____ (40) cm

Gleying or Mottling ☐ n/a _____ (41) cm | Seepage ☐ n/a _____ (42) cm | Restrict.Layer ☐ n/a _____ (43) cm

Restrict.T ype ☐ Cement ☐ Pan ☐ Kompact ☐ Lithic ☐ Water ☐ X Chem. ☐ Z Permafrost

FS 1333 HRE 2010/03

SP P. LIST	COM P. PART.	(44)	% COVER B Y L AYER	TREE (A)	SHRUB (B)	(45)	HERB (C)	MOSS / LICHEN (D)	(46)	ociated Full Cruise Card ? ☐ No ☐ Yes

COL. (47)	TREES & SHRUBS (48)	(49)	A1	A2	A3	A (50)	B1	B2	B

COL. (47)	HERB L AYER (C) (48)	(49)	% (50)

COL. (47)	MOSS / LICHEN / SEEDLING (D) (48)	(49)	% (50)

Notes/Diagram

(52)

Tree Mensuration

SP P. (51)	dbh	Ht.	BH Age	Path. Y/N	Notes

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Site Visit Form (FS1333)

The *Field Manual for Describing Terrestrial Ecosystems* sets coding and methodology standards for data collection of ecosystem plots using the FS882 field form. However, a full ecosystem description is more detailed than required for some project tasks. This section outlines data requirements to follow for reduced levels of ecosystem plot detail using the FS1333 form. In addition, a table of data field standards for each entry of the FS882 and FS1333 is provided in Appendix 8.1, to guide users wishing to create custom forms or databases for specific projects that will be in accordance with provincial data standards.

The FS1333 is designed to be used for reconnaisance-level ecological plot collection at several levels. However, the **FS882** is the preferred for the follow types of plots:

- Full ecosystem plots
- Ecosystem plots with full site information and full species lists but reduced soils information
- Ecosystem plots where soils and terrain information is high priority
- Plots intended to be included in ecosystem classification

The **FS1333** should be used for:

- Ground Inspections - Site Series call with supporting information for audit
- Ground Call - Site Series call with minimal supporting information
- Site Notes - ad hoc ecological site notes
- Other ecosystem-related data collection purposes such as species collections, bioterrain typing, non-timber forest product quality evaluations, etc.

Neither the FS882 nor the FS1333 is specifically designed for assessment of complex map polygons. However, the FS1333 should be used for point assessments in map polygon surveys. Additional polygon-related information can be recorded in Plot Location or Notes sections.

While over 50 data fields are presented on the FS1333 and described in this document, not all are required for every project. The objectives of a study will determine the data to be collected. Project objectives may also require attributes not presented on this form. In these cases, the Notes section can be used and additional fields appended to the database. Fields that are mandatory for all types of plots are highlighted in grey on the field form.

Mandatory Fields for All Plots

For all plot types including customized data forms the *following fields are mandatory:*

1. Project ID
2. Plot Number
3. Checkmark appropriate Plot Type
4. Date
5. Surveyor(s)

11. UTM or Latitude/Longitude
12. Accuracy

Ground Inspection

When completing an FS1333 for a ecosystem ground inspection that may be audited, the entire card should be completed for all appropriate fields.

Ground Call

Ground calls are quick field inspections where minimal information is collected. These plots do not contain the information required for audit or for use in any ecological data compilation. They are intended for georeferenced point information for use in ecological mapping and GIS excercises. An accurate georeferenced location is essential. Generally, a ground call has a purpose: for example, to confirm an ecosystem unit. Commonly, no species information is collected.

The following fields should be completed for all ground calls:
Numbered items refer to numbered fields on the Ground Inspection Form (pages 3 and 4).

1. Project ID
2. Plot Number
3. Checkmark V (visual) box
4. Date
5. Surveyor(s)
11. UTM or Latitude/Longitude
12. Georeference Accuracy
14. BGC Unit
15. Site Series (SS)
19. Elevation
20. Slope %
21. Aspect

Other commonly collected fields:

7. Plot Photo
23. Slope Position
25. Site Disturbance
28. Canopy Composition
29. Structural Stage
30. Successional Status

Notes or Other

"Other" plot types are georeferenced observations where the primary purpose is not ecosystem identification, such as stand health observations, cutblock evaluation, species collections, surveys of non-timber forest product values, etc.

"Notes" are ad hoc observations of a casual nature.
For these two plot types the *following fields are mandatory:*

1. Project ID
2. Plot number
3. Checkmark appropriate Plot Type
4. Date
5. Surveyor(s)
11. UTM or Latitude/Longitude
12. Accuracy

Ground Inspection Field Procedure

Getting Started

1. Select the sample plot. Project objectives will determine how plot locations are selected.
2. Checkmark the "Grnd" (ground) box. Record the date, project ID, surveyor(s) name(s), mapsheet number, plot number, polygon number (if available), and BGC unit.
3. Record latitude and longitude or UTM using field GPS. Record estimated location accuracy.
4. Locate and excavate a soil pit to a depth of about 50 cm.

Measure and Assess

1. Determine the aspect, elevation, and slope.
2. Traverse the entire plot systematically, observing the position of the plot relative to the surrounding landscape, microtopographic features, and the composition of surface substrates. Record meso-slope position.
3. Assess the soils and determine humus form, soil drainage, rooting zone soil texture, and percent coarse fragments. Estimate the depth of soil and rooting depth. Note presence and depth of Ah or Ae horizons, gleying, and seepage. Record the depth and type of root restricting layer, if any, and the depth of the surface organic horizon.
4. Record the terrain texture, surficial material, surface expression, and geomorphological processes.
5. Record the dominant and indicator plant species, noting layer. Evaluate the percent cover by species and total for each layer. Checkmark whether the species list recorded is complete or partial.

6. Confirm BGC unit. Integrate site, soil and vegetation factors to determine soil moisture and soil nutrient regimes, and site series. Note unusual factors or conclusions in the Notes section.
7. Determine the structural and successional stages.
8. Measure or estimate stand age, average stand height, and canopy composition.
9. Describe the key site features under Notes. Draw a site diagram, if important features can be effectively depicted.
10. Check to be sure that all required fields have been completed.

Completing the Form

Numbered items refer to numbered fields on the Site Visit Form (pages: SIVI 3 and 4).

1. Project ID
Enter a descriptor for the type of project and the location. (See Resources Inventory Committee 1998a, Item 3, p. 6.)

2. Plot Number
Record a project-specific number. Use up to seven characters. It is important to use a number series that will be unique to the project. A suggested form is to use plot numbers that are a combination of year + initials + 3-digit running number (e.g., 09WM001).

3. Plot Type
Tick the appropriate box (G _ vs. V _) indicating the type of survey being done: Ground (G) or Visual (V).

4. Date
Enter two-digit codes for year, month, and day (e.g., 97-06-21).

5. Surveyor(s)
Record the first initial and last name of each person involved in the inspection (Surv.).

6. Map Polygon Number
If the inspection is part of a mapping project, record a full polygon identifier where the plot is located. The polygon number will be unique to the project and/or the mapsheet (e.g., 001).

7. Plot Photo
Record the frame number(s) and camera used for plot photos.

8. Plot Location

Describe the location of the plot at a regional and local scale relative to natural features such as mountains or bodies of water and permanent structures such as kilometre signs on main roads. This description should allow other users to locate the general position of the plot on a map and, where required by contract, assist field workers in relocating the plot in the field .

9. FS Region/District

This information can be useful for sorting plot data. Use the following codes:

RCO = Coast Forest Region
RNI = Northern Interior Forest Region
RSI = Southern Interior Forest Region

District codes may also be recorded in the form RCO.DHG (Haida Gwaii District). Forest District codes are listed in Appendix 1.1 in Section 1 of this field manual.

10. Mapsheet

Using the BC Geographic System, identify the mapsheet where the inspection is located (e.g., 93H 015).

11. Latitude/Longitude or Northing/Easting

Determine the precise location of the plot (Lat./North. & Long./East). Georeferencing should be determined using GPS. Although either co-ordinate system may be used, the Latitude/Longitude system is preferred.

- For latitude and longitude, note degrees (°), minutes ('), and seconds (").
- For UTM system, record zone and northing and easting.

12. Accuracy

Record the estimated georeferencing accuracy in metres.

13. Plot Representing

Provide a statement that outlines the important characteristics of the sampled ecosystem. Plot Representing should provide a concise description describing the key attributes of the site.

For example:

- 30-year-old planted Pl stand; kinnikinnick, lichens on FG terrace
- Productive zonal Fd - Pinegrass stand on warm aspect
- Mature Sxw– Horsetail–Ladyfern, Hydromor, Humic Gleysol, on floodplain

14. Biogeoclimatic Unit

Enter a code for the biogeoclimatic zone and subzone; include variant and phase where applicable. Transitional areas can be coded.

15. Site Series

Enter a two-digit site series code and a letter code for site series phases, where recognized, from the appropriate MFR regional field guide for site identification and interpretation.

Note the following special cases:

- Where site characteristics are uniform but distinctly transitional between two recognized site series, indicate with a dash (e.g., 01a-05).
- If the ecosystem does not resemble a recognized site series, leave this field blank, and explain under NOTES.

16. Soil Moisture Regime

Enter a code (0–8) for soil moisture regime (SMR). (See Resources Inventory Committee 1998a, Item 20, p. 9)

17. Soil Nutrient Regime

Enter a code (A–F) for soil nutrient regime (SNR). (See Resources Inventory Committee 1998a, Item 21, p. 11)

18. Map Label

If the plot is part of a mapping project, enter appropriately formatted map code for the terrestrial ecosystem (TEM) or other map unit (soils, terrain, etc.). TEM unit coding is as follows:

Site series	Site modifier	Structural stage
SS	**mm**	**#xx**

19. Elevation

Record elevation, in metres, using an altimeter or GPS.

20. Slope

Record percent slope gradient, measured with a clinometer or similar instrument.

21. Aspect

Record the orientation of the slope, measured by compass, in degrees (enter due north as 0°; level ground as "999").

22. Surface Shape

Mark the appropriate surface shape box.

23. Meso Slope Position

Checkmark the appropriate box to indicate the position of the plot relative to the localized catchment area.

24. Exposure Type
If significant localized atmospheric and climate-related factors are reflected in atypical soil and/or vegetation features, mark the appropriate box. If existing codes are inadequate, mark "other" box and and explain in space provided. If there is no evidence of exposure to anomalous conditions, mark the n/a box.

25. Site Disturbance
Note any events that have caused vegetation and soil characteristics to differ from those expected at climax for the site. Be as specific as possible, including codes for the category and specific types of disturbance separated by periods. Record up to three different types of disturbance, separated by slashes. For example, enter **L.c./F.l.bb** for a clearcut that has been broadcast burned. If existing codes are inadequate, enter an "X" here and explain under Notes.

26. Stand Age
Record the approximate age of the stand based on tree cores, inventories, or other sources of information where appropriate. Mark the appropriate box indicating whether stand age was estimated or measured.

27. Stand Height
Record the average height of the stand using the dominant canopy (generally the A2, B1, or B2 layers). Mark the appropriate box indicating that stand height was estimated or measured.

28. Canopy Composition
If the stand is forested, record the canopy composition using two-letter tree species codes separated by single digits representing each 10% of canopy cover (e.g., Pl7 Bl2 At1 for 70% lodgepole pine, 20% subalpine fir, 10% aspen).

29. Structural Stage
Mark the appropriate structural stage box.

30. Successional Status
Mark the appropriate successional status of the stand.

31. Terrain Classification
Fields are provided for recording terrain texture, surficial material, surface expression, and geomorphologic processes (Geomorph Process). Up to three codes can be used in each of these fields. The first line on the form is for the uppermost stratigraphic layer; the second for an underlying layer. Refer to *Terrain Classification System for British Columbia* (Howes and Kenk 1997) for further information.

32. Rock Types
Record dominant rock types for coarse fragment lithography.

33. Drainage
Checkmark the box for the appropriate drainage class. Drainage describes the speed and extent at which water is removed from a mineral soil, in relation to supply.

34. Humus Form
Examine the humus form profile and tick the appropriate box (see Soil Description).

35. Humus Thickness
Measure the surface organic horizon, in centimetres, from the top of the ground surface to the top of the first mineral horizon. Checkmark the appropriate box.

36. A Horizon Characteristics
If an A horizon is present, mark the appropriate type box and record the thickness of the horizon in centimetres.

37. Estimated Soil Depth
Record the thickness of the entire soil profile from the ground surface to a root restricting layer. If no restricting layer is noted in the soil pit, estimate the depth of soil based on nearby road cuts or other indicators of active seepage or water table. If no seepage is present, mark the n/a box.

38. Rooting Zone Soil Texture
Determine soil texture in the rooting zone of the soil profile and tick the appropriate box.

39. Rooting Zone Coarse Fragment %
Estimate the percent coarse fragment (>2 mm diameter) volume in the rooting zone of the soil profile and tick the appropriate box for the range.

40. Estimated Rooting Depth
Record the depth (from the ground surface) at which the majority of roots stop (e.g., rooting abundance drops from “plentiful” to “few”).

41. Gleying/Mottle Depth
Record the depth (from the ground surface) at which mottles or gleying appear. If no mottling is present, mark the n/a box.

42. Seepage Depth
Record the depth (from the ground surface) of active seepage or water table. If no seepage is present, mark the n/a box.

43. Root Restricting Layer Depth and Type
Identify and record the type of root restricting layer, if present. Mark the n/a box if no restricting layer is observed. Measure and record the depth in centimetres. from the ground surface (top of the humus layer). Mark the appropriate type code.

44. Plant List Complete or Partial
Checkmark the appropriate box to indicate if the vegetation list is comprehensive (Complete) or lists only a portion of the plants observed at the site (Partial).

45. Total %
Estimate the total percent cover for each layer indicated (A, B, C, D) as a percentage of the sample area (plot).

46. Full Cruise Card?
If detailed mensuration data has been collected and recorded on a cruise card, mark the "yes" box. Use the same plot number for the FS1333 and associated cruise card.

47. Col.?
Mark this column if a voucher specimen for the species has been collected.

48. Dominant/Indicator Plant Species
List the dominant and indicator species under the appropriate strata using provincial plant species codes (see Resources Inventory Committee 1998a,Vegetation Species Lists, pg. 6). If a full species list is being recorded in addition to the information on page 1 of the FS1333, an FS882 is the appropriate form to use.

49. Additional Species Attributes
Where additioanl species attributes are being assessed, write code type in header and record appropriate code for each assessed species.

50. Percent Cover
Record the percent cover for each species as a percentage of the sample area (plot) both by layer (A1, A2, A3, B1, and B2) and by strata (total A and total B) as appropriate.

51. Tree Mensuration

Enter information, as required by project objectives.

52. Notes

Record additional information here, for example:

- further characterization of the site
- explanation of unusual entries elsewhere on the form
- data specific to a particular project that is not accommodated elsewhere on the forms
- site diagram.

Appendix 8.1 Data Field Standards

Field Name	Field Type	Field Size	GI	GC	SN
Fields marked with "x" are mandatory for the level of details outlined Fields Marked with "o" are suggested fields GI= Ground inspection; GC=Ground Call; SN= Site Notes/Other					
Project and Plot					
PlotNumber	Text	7	x	x	x
FieldNumber	Text	50	o	o	o
ProjectID	Text	30	x	x	x
FSRegionDistrict	Text	7	o		
Date	Date/Time	8	x	x	x
SiteSurveyor	Text	30	x	x	x
PlotRepresenting	Text	255	x	x	x
Location	Text	255	x	x	x
Ecosection	Text	3			
NtsMapSheet	Text	8			
Longitude	Single	4	x	x	x
Latitude	Single	4	x	x	x
UTMZone	Text	2	x	x	x
UTMEasting	Single	4	x	x	x
UTMNorthing	Single	4	x	x	x
LocationAccuracy	Integer	2	x	x	x
AirPhotoNum	Text	20			
XCoord	Single	4			
YCoord	Single	4			
Photo	Text	50	x	o	o
SiteNotes	Memo	-	x	x	x
Ecosystem and Stand					
Zone	Text	4	x	x	x
SubZone	Text	8	x	x	x
SiteSeries	Text	5	x	x	o
TransDistrib	Text	3	o		
RealmClass	Text	5	x	x	
MapUnit	Text	15	o	o	o
MoistureRegime	Text	3	x	x	
NutrientRegime	Text	2	x	x	
SuccessionalStatus	Text	3	x	x	o
StructuralStage	Text	6	x	x	o
StructuralStageMod	Text	1	o	o	
StandAge	Integer	2	o	o	o

Field Name	Field Type	Field Size	GI	GC	SN
Site					
Elevation	Integer	2	x	x	x
SlopeGradient	Single	4	x	x	o
Aspect	Integer	2	x	x	o
MesoSlopePosition	Text	3	x	x	
SurfaceShape	Text	3	x		
SurfaceTopographyType	Text	3			
SurfaceTopographySize	Text	2			
WaterSource	Text	5			
Exposure1	Text	2	x	x	
Exposure2	Text	2			
SiteDisturbance1	Text	8	x	x	
SiteDisturbance2	Text	8	o		
SiteDisturbance3	Text	8			
SubstrateDecWood	Single	4			
SubstrateBedRock	Single	4			
SubstrateRocks	Single	4			
SubstrateMineralSoil	Single	4			
SubstrateOrganicMatter	Single	4			
SubstrateWater	Single	4			
Soils and Terrain					
SoilSurveyor	Text	30			
BedrockGeology1	Text	4			
BedrockGeology2	Text	4			
BedrockGeology3	Text	4			
CoarseFragLith1	Text	12			
CoarseFragLith2	Text	12			
CoarseFragLith3	Text	12			
TerrainTextureSurf	Text	3	x		
SurficialMaterialSurf	Text	6	x		
SurfaceExpSurf	Text	3	x		
GeoMorProSurf	Text	3			
TerrainTextureSubSurf	Text	3			
SurficialMaterialSubSurf	Text	6			
SurfaceExpSubSurf	Text	3			
GeoMorProSubSurf	Text	3			
FloodingRegimeFreq	Text	7			
MoistureRegimeSub	Text	3			
FloodingRegimeDur	Text	2			
SoilDrainage	Text	5			
SeepageDepth	Integer	2	x		

Field Name	Field Type	Field Size	GI	GC	SN
RootRestrictingType	Text	1	x		
RootRestrictingDepth	Integer	2	x		
RootZoneParticleSize	Text	6	x		
RootingDepth	Integer	2	x		
SoilClassSubGroup	Text	4			
SoilClassGroup	Text	4			
HumusForm	Text	4	x	5	5
HumusFormPhase	Text	50			
HumusThickness	Single	4			
pHMethodCodeMineral	Text	3			
pHMethodCodeOrganic	Text	3			
SoilNotes	Memo	-			
HydroGeoSystem	Text	3			
HydroGeoSubSystem	Text	2			
Soil and Humus Horizons					
All Horizons					
Horizon	Text	8	x		
UpperDepth	Single	4			
LowerDepth	Single	4			
RootsAbundance	Text	3			
RootsSize	Text	3			
Comment	Memo	-			
Humus Horizons					
HumusStructureDegree	Text	1			
HumusStructureKind	Text	5			
MycelAbundance	Text	1			
FecalAbundance	Text	1			
vonPost	Integer	2			
HumusFormpH	Single	4			
Consistence	Text	2			
Character	Text	2			
Fauna	Text	4			
Mineral Horizons					
PitDepthLimit	Text	1			
Colour	Text	14			
ASP	Integer	2			
Texture	Text	4			
PercentCoarseFragsGravel	Integer	2			
PercentCoarseFragsCobbles	Integer	2			
PercentCoarseFragsStones	Integer	2			
PercentCoarseFragsTotal	Integer	2	x		

Field Name	Field Type	Field Size	GI	GC	SN
PercentCoarseFragsShape	Text	1			
MineralStructureClass	Text	3			
MineralStructureKind	Text	7			
MineralFormpH	Single	4			
MottlesAbundance	Text	1			
MottlesSize	Text	1			
MottlesContrast	Text	1			
ClayFilmsFreq	Text	2			
ClayFilmThickness	Text	3			
Effervescence	Text	2			
Porosity	Text	1			
Vegetation					
VegSurveyor	Text	30			
StrataCoverTree	Single	4	x		
StrataCoverShrub	Single	4	x		
StrataCoverHerb	Single	4	x		
StrataCoverMoss	Single	4	x		
VegNotes	Memo	-	x		
SpeciesListComplete	Yes/No	1	x		
Species Attributes					
Species	Text	8	x		
Cover1	Single	4	x		
Cover2	Single	4	x		
Cover3	Single	4	x		
TotalA	Single	4	x		
Cover4	Single	4	x		
Cover5	Single	4	x		
TotalB	Single	4	x		
Cover6	Single	4	x		
Cover7	Single	4	x		
Cover8	Single	4			
Cover9	Single	4			
Cover10	Single	4			
Height1	Single	4			
Height2	Single	4			
Height3	Single	4			
Height4	Single	4			
Height5	Single	4			
Height6	Single	4			
Collected?	Text	1			

Field Name	Field Type	Field Size	GI	GC	SN
Lichen Loading	Long Integer	4			
Available Forage	Integer	2			
Distribution	Integer	2			
Utilization	Integer	2			
Vigour	Integer	2			
Phenology - vegetative	Long Integer	4			
Phenology - generative	Integer	2			
Fruit-Flower Abundance	Integer	2			
Cultural1	Integer	2			
Cultural2	Integer	2			
Other1	Integer	2			
Other2	Integer	2			
CWD					
CWDTransectLength	Single	4			
CWDTransectSampled	Single	4			
CWDAzimuth	Single	4			
CWD Pieces					
Subplot	Text	3			
TransectNum	Byte	1			
PieceNumber	Integer	2			
TreeSpp	Text	3			
Diameter	Single	4			
DecayClass	Byte	1			
Angle	Integer	2			
Length	Single	4			
HeightOfEnd	Single	4			
AngleGround	Single	4			
Volume	Single	4			
CWD Piles					
Pile Number	Integer	2			
Pile Size Length	Single	4			
Pile Size Width	Single	4			
Pile Size Height	Single	4			
Pile Size Diameter	Single	4			
Pile Inter Space	Text	1			
Mensuration/Tree Attributes					
PlotSize	Single	4			
dbh Limit	Single	4			
BAF	Single	4			
Cruise?	Yes/No	1			

Field Name	Field Type	Field Size	GI	GC	SN
Tree Notes	Memo	-			
Tree Measurements					
Subplot	Text	3			
TreeNUM	Integer	2			
TreeSpp	Text	3			
dbh	Single	4			
TotalHtCalc	Single	4			
Count Age	Integer	2			
Count Height	Single	4			
Total Age	Integer	2			
Tree Health	Byte	1			
Tree Origin	Text	1			
Conks	Byte	1			
BlindConks	Byte	1			
Scars	Byte	1			
ForkOrCrook	Byte	1			
FrostCrack	Byte	1			
Mistletoe	Byte	1			
RottenBranch	Byte	1			
DeadOrBrokenTop	Byte	1			
DamageType	Text	3			
DamageSeverity	Text	1			
CrownClass	Text	1			
Ht2LiveCrown	Single	4			
Appearance	Byte	1			
CrownCondition	Byte	1			
BarkRetention	Byte	1			
WoodCondition	Byte	1			
LichenLoading	Byte	1			
MossLoading	Byte	1			
WildLifeUse	Text	17			
Wildlife Habitat Assessment					
Wildlife Species	Text	6			
PlotSex	Text	1			
PlotLifeStage	Text	1			
PlotActivity	Text	2			
PlotDescriptor	Text	1			
PlotNumberCount	Text	5			
PlotUseComments	Memo	-			
Evidence of Use					
EUSex1	Text	1			

Field Name	Field Type	Field Size	GI	GC	SN
EULifeStage1	Text	1			
EUActivity1	Text	2			
EUDescriptor1	Text	1			
EUNumberCount1	Text	5			
EuSex2	Text	1			
EULifeStage2	Text	1			
EUActivity2	Text	2			
EUDescriptor2	Text	1			
EUNumberCount2	Text	5			
EUComments	Memo	-			
Wildlife Management					
ManagementSpecies	Text	6			
ManagementUse	Text	2			
ManagementSeason	Text	2			
ManagementFC_LR	Text	2			
ManagementCapability	Byte	1			
ManagementTechniques	Text	2			
ManagementFeasibility	Text	2			
ManagementComments	Memo	-			

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9 KEYS AND CODES

9.1 Field equipment check list

General:
- LMH 25
- Field cards
- Felt pen and pencils
- Field notebook

Site:
- Regional Field Guides
- GPS
- Compass
- Digital camera

Vegetation:
- Plant identification guides
- Hand lens
- Collection bags

Soils:
- Shovel
- Polaski
- Metric measuring tape
- Trowel or soils knife
- White golf tees (marking horizons)
- pH kit and 10% HCl
- Pruners
- Water bottle for texturing
- Munsell colour charts

Optional Soils Equipment:
- Cloth measuring tape and 4x6" index cards for photos
- Hand lens
- Folding saw
- Rock hammer
- Plastic bags for soil samples
- Small 2mm sieve
- Upland and/or wetland augers
- Umbrella or tarp
- J cloth
- References

Mensuration:
- Vertex or other height tools
- Diameter tape
- Releskop or prism set
- Increment borer
- Straws and tape (for transport of cores)
- Flagging tape (marking trees)
- Critical distance tables

9.2 Determining relative soil moisture and nutrient regime

Determining relative soil moisture and nutrient regime is a critical step in ecosystem identification. This section provides brief descriptions of the key terms used in determining these characteristics. For further information refer to Items 23 and 24 in the Site Description section.

Determining Relative Soil Moisture Regime

The definitions of categories in Table 9.3 on the next page should be read carefully before using the keys to relative soil moisture regime (9.4 and 9.5). Slope position is difficult to assess since line of vision to see a whole slope and determine where transitions occur is obstructed by taller vegetation. For this reason it is useful to examine air or ortho photos prior to going in the field in order to determine slope position. It is also useful to walk the slope in order to determine where the top and bottom of the slope are located in reference to the location being assessed. It is sometimes difficult to tell if a slope break is affecting water flow. In order to do this walk through the slope break and see if the vegetation is reflecting drier conditions (upper slope break) or wetter conditions (lower slope break). If the vegetation changes than the break is affecting water flow.

Determining Relative Soil Nutrient Regime

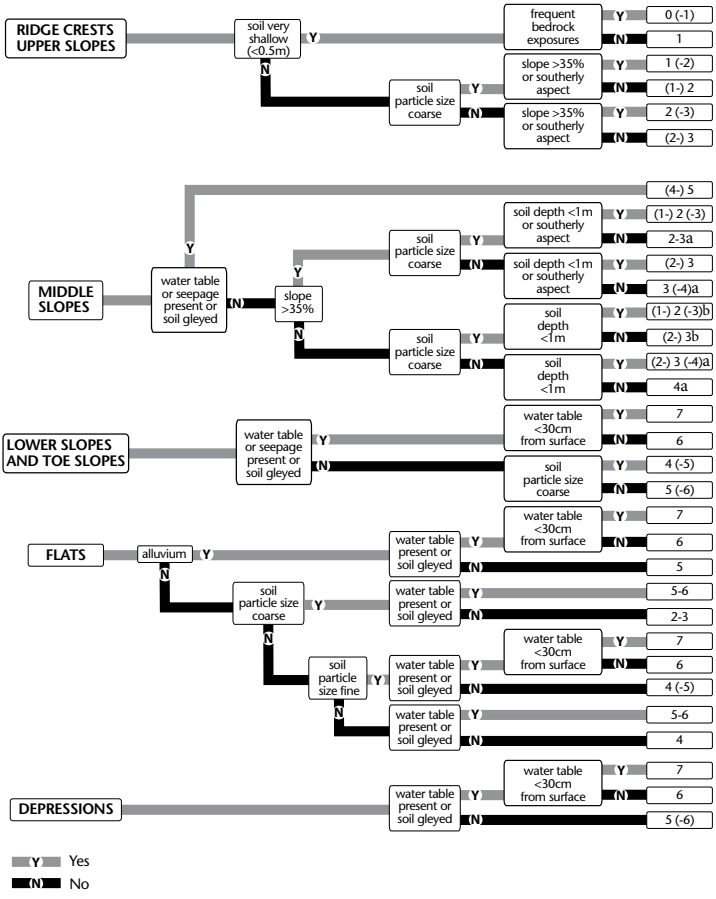
Determining relative soil nutrient regime (RSNR) is generally more difficult than determining relative soil moisture regime since some of the factors influencing it are not easily assessed (e.g., soil structure). One of the key factors for determination of RSNR is humus form (see Section 2, Soil Description, or 9.16 in this seciton). Keys to RSNR (9.7, 9.8 and 9.9) and a comparative table (9.6) are provided below to assist with determination of RSNR. Before using the key and table, carefully read the definitions in Table 9.3 on the next page.

9.3 Definitions of terms used in the keys to identification of relative soil moisture and nutrient regimes [a]

Category	Definition
Ridge crest [b]	height of land; usually convex slope shape (soil water shedding).
Upper slope [b]	the generally convex-shaped, upper portion of a slope (soil water mostly shedding).
Middle slope [b]	the portion of a slope between the upper and lower slopes; the slope shape is usually straight (soil water shedding/receiving more or less equally).
Lower slope [b]	the area towards the base of a slope; the slope shape is usually concave (soil water receiving). It includes toe slopes, which are generally level areas located directly below and adjacent to the lower slope.
Flat/level [b]	any level area (excluding the slopes); the surface shape is generally horizontal with no significant aspect (sites receive and maintain soil water, depending on soil depth and texture).
Depression [b]	any area that is concave in all directions; usually at the foot of a slope or in flat topography.
Alluvium/Fluvial Landforms	post-glacial, active floodplain deposits along rivers and streams in valley bottoms; usually a series of low benches and channels.
Soil depth	depth from the ground (forest floor) surface to a restricting layer, such as bedrock, strongly compacted materials, or strongly cemented materials (e.g.,"hardpan").
Gleyed	soils that have orange-coloured mottles indicative of a fluctuating water table. Permanently gleyed soils are blue grey to turquoise grey in colour.
Buried organic horizons	dark coloured organic bands or streaks occurring within mineral horizons at depth, resulting from mineral deposition over old surface (forest floor) horizons by flooding or soil turbation.
Soil particle size coarse	sandy [c] with >35% volume of coarse fragments, or loamy [c] with >70% volume of coarse fragments.
Soil particle size fine	silty [c] or clayey [c] with <20% volume of coarse fragments.

a Modified from Lloyd et al. (1990) and Green et al. (1994).
b See also Figure 1.2 Mesoslope position in this document; Site Description section, p. 26.
c Sandy – LS, S; loamy – SL, L, SCL; clayey – SiCL, CL, SC, SiC, C; silty – SiL, Si.

9.4 Key to soil moisture regimes [c, d]



a Generally moister if aspect is N or NE
b Generally drier if aspect is S or SW
c Caution: read the definitions of particle size and gleying in 9.19 Soil texture key
d Adapted from Banner et al 1993

9.5 Key for evaluating site factors and determining soil moisture regime classes

Site factors	Factors that reduce available moisture (–)			Intermediate moisture (0)	Factors that increase available moisture (+)					Site assessment *
Mesoslope position	Crest **-15**	Upper **-8**		Middle or Level **0**	Lower **+3**	Toe **+5**	Depression **+10**			
Slope gradient		>60% **-4**	35–60% **-2**	5–35% **0**	0–5% **+2**					
Aspect – Gentle slopes ≤35%		S SW **-2**	W NW **-1**	E SE **0**	N NE **+1**					
Aspect – Steep slopes >35%	SW **-5**	W S **-4**	SE NW **-2**	E **0**		N NE **+5**				
Soil texture	S **-10**	LS **-6**	SL **-2**	SiL,L **0**	Si,SCL CL, SiCL **+1**	SC, SiC, C **+2**	Organic **+3**			
Coarse fragment content	>85% **-10**	65–85% **-6**	35–65% **-3**	10–35% **0**	0–10% **+2**					
Soil depth (cm): for soils lacking a water table or gleyed horizon	0–25 **-18**	25–50 **-8**	50–100 **-4**	>100 **0**						
Depth to water or gleying (cm				Absent **0**	100–150 **+5**	75–100 **+15**	50–75 **+25**	25–50 **+55**	<25 **+85**	

*Totaling the values for each site factor gives an estimate of soil moisture regime. Total _____

Soil moisture regime classes and codes	Very Xeric 0	Xeric 1	Subxeric 2	Submesic 3	Mesic 4	Subhygric 5	Hygric 6	Subhygric 7
Class ranges	**<-32**	**-32 to -21**	**-20 to -11**	**-10 to -5**	**-4 to +4**	**+5 to +39**	**+40 to +70**	**>70**

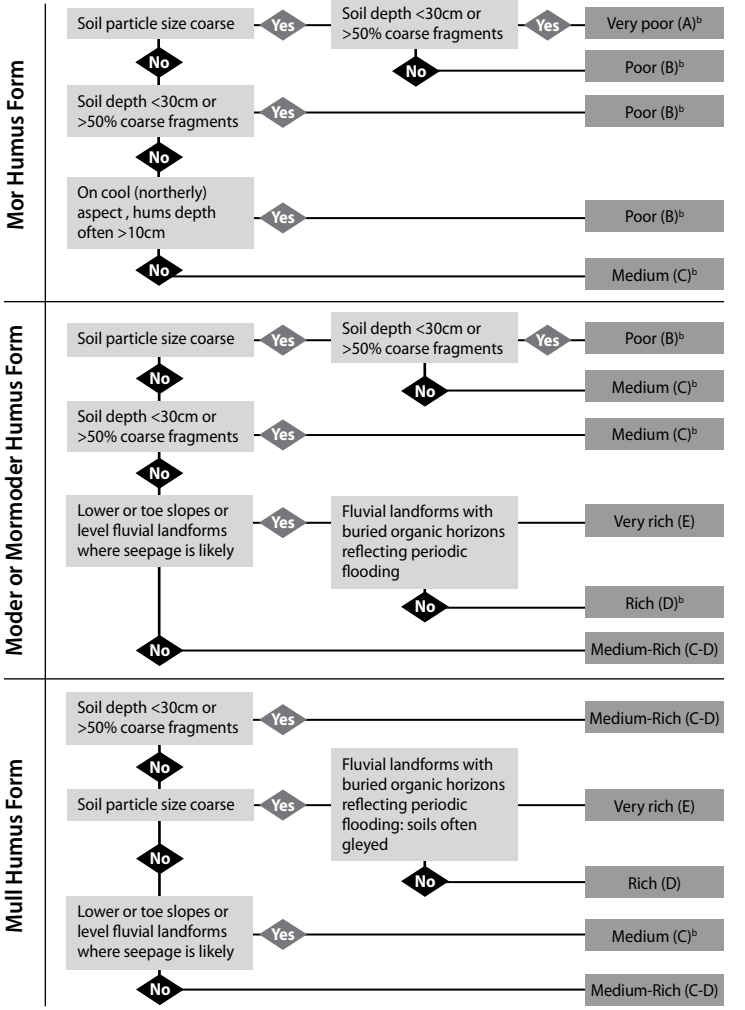
From Lloyd et al. 1990

9.6 Table for estimation of soil nutrient regime

	A very poor	B poor	C medium	D rich	E very rich	F saline
Available nutrients	very low	low	average	plentiful	abundant	excess salt. accum.
Humus form	**Mor**					
			Moder			
				Mull		
A horizon	**Ae horizon present**					
			A horizon absent			
				Ah horizon present		
Organic matter content	**low (light coloured)**					
		medium (intermediate)				
			high (dark coloured)			
C:N ratio	**high**					
			moderate			
				low		
Soil texture	**very coarse**	**coarse**	**medium**	**fine**	**very fine**	
Examples	LS, 60% CF		L, 25% CF	SiCl, 15% CF	SiC, 15% CF	
Slope position related to seepage	**upper** shedding		**mid** normal		**lower** receiving	
Depth to impermiable layer	**shallow** < 0.5 m		**medium** 1–2 m		**deep** >2 m	
Coarse fragment type **colour**	light		medium, mixed		dark unless calcareous	
texture	coarse		medium		fine	
hardness	hard		medium		soft	
examples	granite quartzite sandstone	granodiorite	diorite schist argillite	gabbro	basalt slate limestone	
Soil pH	**extremely – mod. acid**					
		moderately acid-neutral				
				slightly acid – mildly alk.		
Water pH (wetlands)	<4–5	4.5–5.5	5.5–6.5	6.5–7.4	>7.4	
Seepage			**temporary** →		**permanent**	

Modified from Banner et al. 1993 and LMH25 1st Ed.

9.7 Nutrient regime key for upland sites [a]



a This key should be used in conjuction with Table 9.6 when identifying relative soil nutrient regime. See Table 9.3, this Section, for definitions of terms used in this key.

b On sites dominated by mature broadleaf trees, increase nutrient regime class by one category (e.g., med to rich).

From Delong et al. 2010

9.8 Key for indentifying soil nutrient regime factors on non-saturated sites

Site factors	Factors that reduce available moisture (−)				Intermediate nutrient status (0)	Factors that increase available moisture (+)			Site assessment *
Rooting depth (cm)	<10 (-7)	10-20 (-5)	20-35 (-2)		>35 (0)				
Soil texture		S (-3)	LS (-2)	SL (-1)	SiL, L, Si (0)	SCL, CL, SiCL (+1)	SC, SiC, C (+2)	Organic (+3)	
Coarse fragment content	>85% (-6)	65%–85% (-4)	35–65% (-2)		10–35% (0)	0–10% (+1)			
Humus form		Mor >20cm (-5)	Mor (-2)		Mor Moder (0)	Moder (+3)	Mull (+6)		
A horizon		Ae >3 cm (-3)	Ae 1–3 cm (-1)		Thin or Absent (0)	Ah 1–5 cm (+3)	Ah>5 cm (+6)		
Seepage water					Absent (0)	Temporary (+3)	Continous (+5)	Alluvial (+7)	
Coarse fragment geology ** — Colour		Light (-3)			Medium (0)	Dark (+3)			
Coarse fragment geology ** — Crystal size			Coarse (-2)		Medium (0)	Fine (+1)			
Coarse fragment geology ** — Hardness				Hard (-1)	Medium (0)	Soft (+1)			
									Total ___

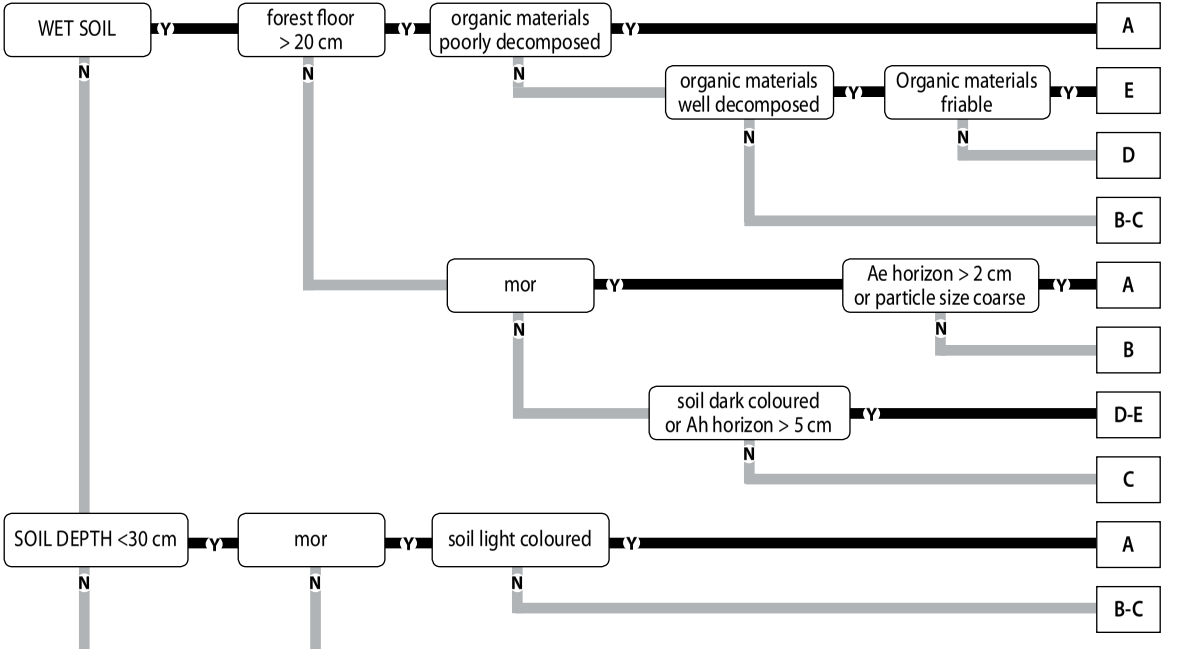
* Totaling the values for each site factor gives an estimate of soil moisture regime.

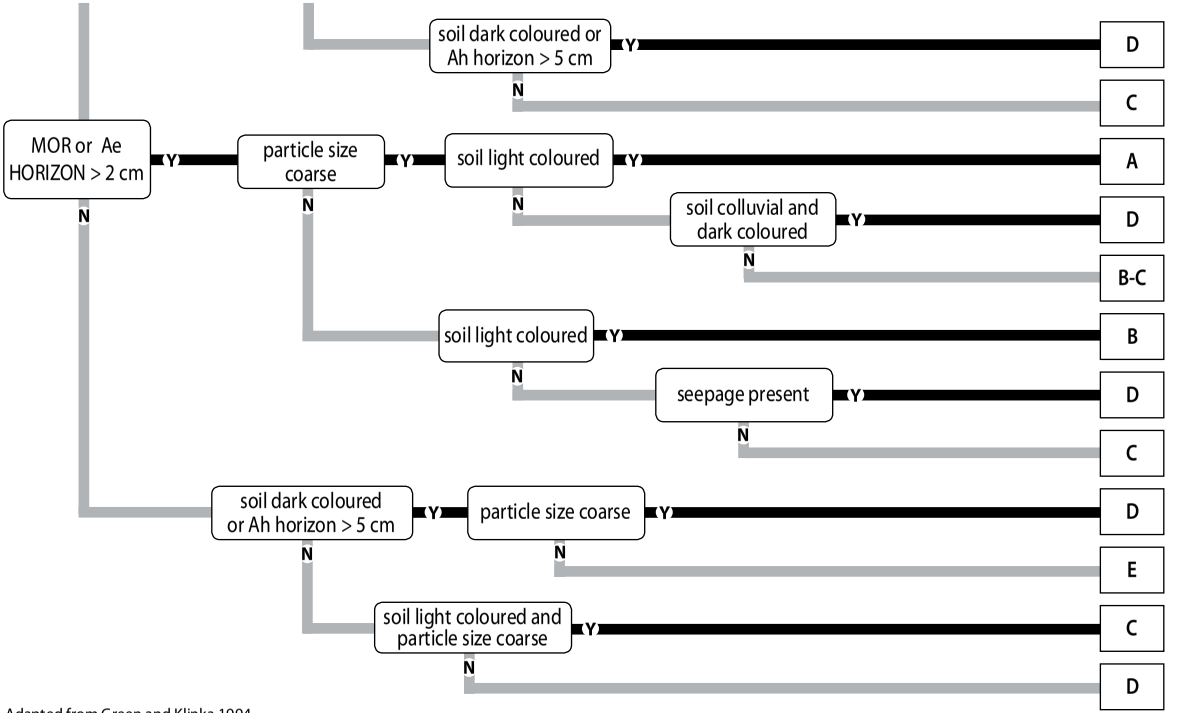
** For sites with a mixed geologic composition, estimate the mean. Calcareous rock types should be rated +6. Those able to identify geologic rock types may choose to use the rating class outlined in Figure 8 instead of colour, crystal size and hardness

Nutrient regime classes and codes	Very Poor A	Poor B	Medium C	Rich D	Very Rich E
Class ranges	≤ -13	-12 to -6	-5 to +5	+6 to +12	≥ +13

Note: Adapted from Lloyd et al. 1990. This key should be used in conjuction with Table 9.6 to identify relative soil nutrient regime. See Table 9.3 for definitions of terms in this key.

9.9 Key to soil nutrient regime





Adapted from Green and Klinka 1994

NOTES

9.10 Site disturbance codes

A. Atmosphere-related effects

Use these codes if causative factors are no longer in effect or are isolated incidents. If effects are ongoing, code as an "Exposure Type" (Item 32).

- **e.** climatic extremes
  - **co** extreme cold
  - **ht** extreme heat
  - **gl** glaze ice
  - **ha** severe hail
  - **sn** heavy snow
- **p.** atmospheric pollution
  - **ac** acid rain
  - **to** toxic gases
- **w.** windthrow

B. Biotic effects

- **b.** beaver tree cutting
- **d.** domestic grazing/browsing
- **w.** wildlife grazing/browsing (5.1) *
- **e.** excrement accumulation (other than that normally associated with grazing/browsing) (5.1) *
- **i.** insects (4.2) *
  - **ki** insect kill
  - **in** infestation
- **p.** disease (4.2) *
- t. turbation (soil)
- **v.** aggressive vegetation

D. Disposals

- **c.** chemical spill or disposal
- **e.** effluent disposal
- **g.** domestic garbage disposal
- **o.** oil spill or disposal
- **r.** radioactive waste disposal or exposure

F. Fires

- **c.** overstorey crown fire
- **g.** light surface (ground) fire
- **r.** repeated light surface fires
- **s.** severe surface fire

* Record type or species under "Notes" using codes given in 9.21, Damage Agent and Conditions Codes or Appendix 5.1 in the Wildlife Habitat Assessment section.

- **i.** repeated severe surface fires
- **l.** burning of logging slash
  - **bb** broadcast burn
  - **pb** piled and burned
  - **wb** burned windrows

L. Forest harvesting

- **l.** land clearing (includes abandoned agriculture)
- **a.** patch cut system
  - **wr** with reserves
- **c.** clearcut system (if slashburned, see also "Fires")
  - **wr** with reserves (patch retention)
- **d.** seed tree system
  - **un** uniform
  - **gr** grouped
- **e.** selection system
  - **gr** group selection
  - **si** single tree
  - **st** strip
- **s.** shelterwood system
  - **un** uniform
  - **gr** group
  - **st** strip
  - **ir** irregular
  - **na** natural
  - **nu** nurse tree
- **o.** coppice

M. Plant or site modification effects

- **c.** herbicide use (chemical)
- **f.** fertilization (specify type under "Notes")
- **i.** irrigation
- **g.** seeded or planted to grasses
- **h.** seeded or planted to herbs
- **s.** planted or seeded to shrubs
- **t.** planted or seeded to trees

P. Gathering or removal of plant products

- **f.** firewood gathering
- **m.** mushrooms
- **o.** moss
- **s.** shrubs (e.g., salal, falsebox)
- **x.** other (specify under "Notes")

S. Soil disturbance

- **a.** cultivation (agricultural)
- **c.** compaction
- **g.** gouging (> 5 cm into mineral soil)
- **s.** scalping (forest floor removed)
- **f.** sidecast/fill
- **r.** road bed, abandoned
- **t.** railway, abandoned
- **e.** excavation
- **m**. mining effects
  - **pt** placer tailings
  - **rq** rock quarrying (including open pit mines)
  - **ta** tailings
- **p.** mechanical site preparation
  - **bb** brush blading
  - **ds** drag scarification (anchor chain or shark fin)
  - **dt** disc trenching
  - **md** mounding
  - **ps** patch scarification
  - **vp** V-plowing
  - **xx** other (specify under "Notes")

T. Terrain-related effects

- **a.** avalanche
- **d.** recent deglaciation
- **e.** eolian (active deflation or deposition)
- **s.** terrain failures (active/recent slumps, slides, solifluction, etc.)
- **v.** volcanic activity

W. Water-related effects

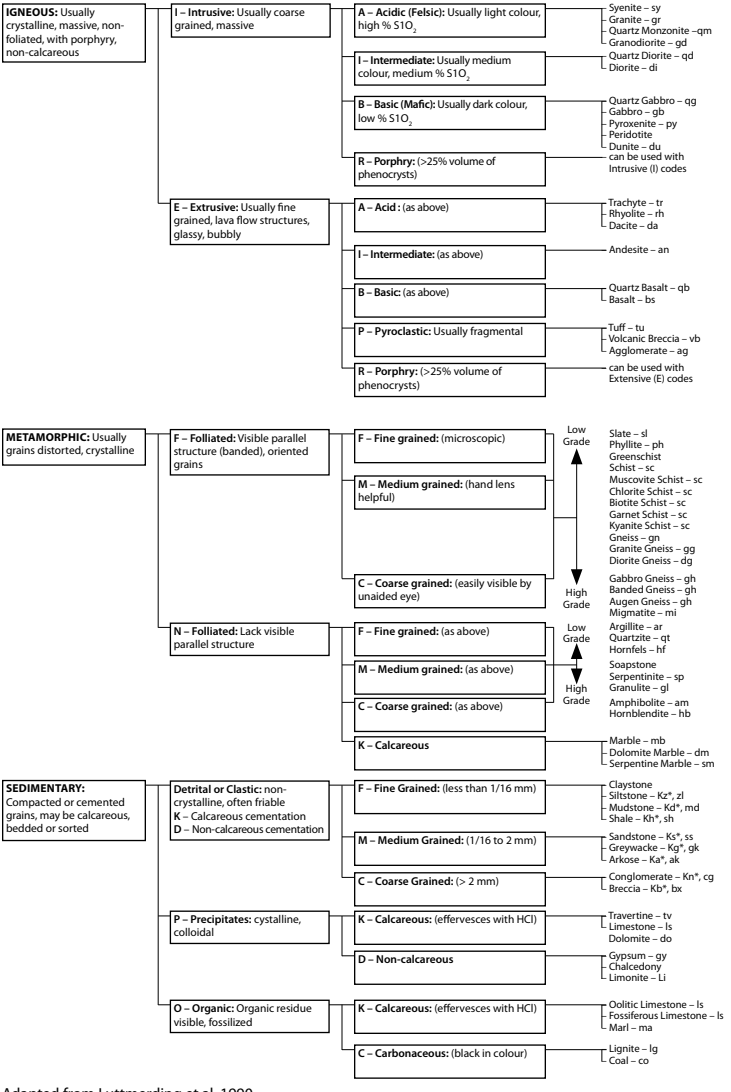
- **i.** inundation (including temporary inundation resulting from beaver activity)
- **s.** temporary seepage (usually artificially induced; excludes intermittent seepage resulting from climatic conditions)
- **d.** water table control (diking, damming)
- **e.** water table depression (associated with extensive water extraction from wells)

X. Miscellaneous

(For other disturbance types, enter "X" and describe under "Notes")

NOTES

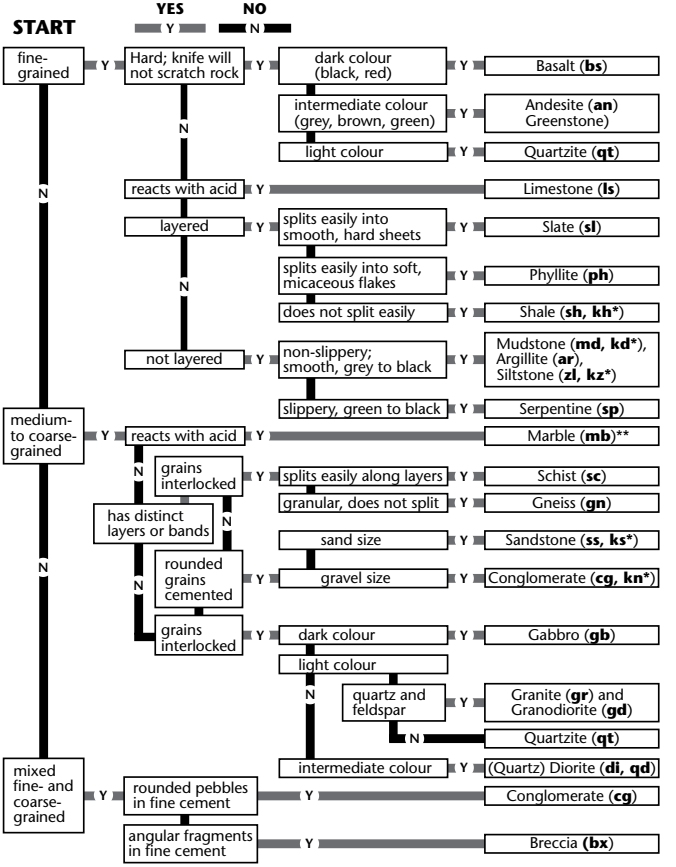
9.11 Key to common rock types



Adapted from Luttmerding et al. 1990

* Calcareous, will effervesce with HCl

9.12 Key to common rock types of British Columbia

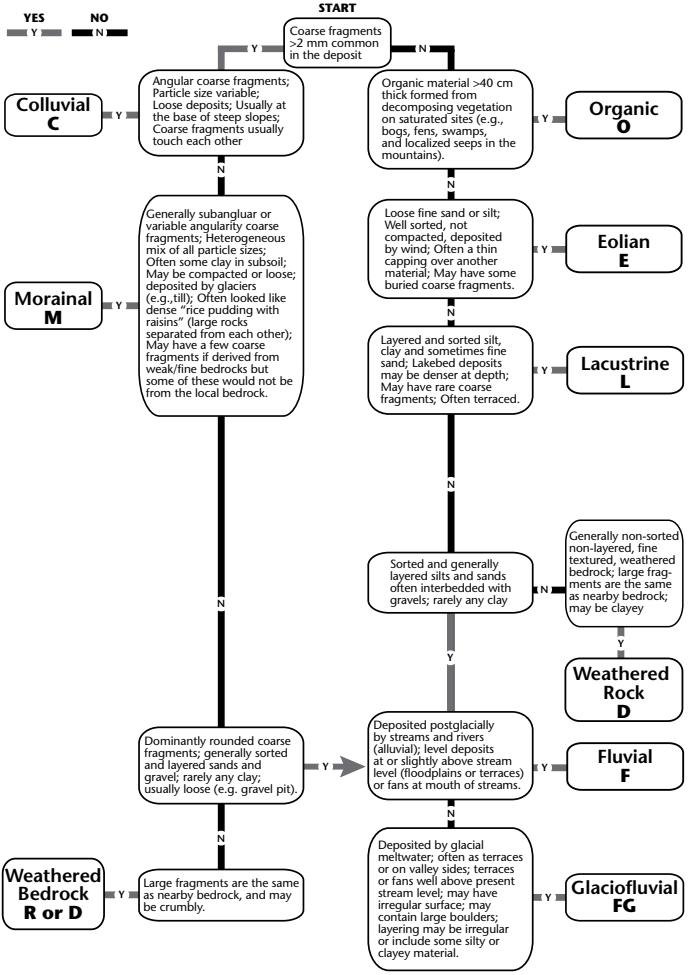


Adapted from Braumandl and Curran (1992) and Lloyd et al. (1990)

* Both calcareous and non-calcareous rock types exist, if reacts with acid record code indicated by asterisk.

** Other rock types do react to acid, although less common in British Columbia

9.13 Key to surficial material



a Adapted from Braumandl and Curran (1992) and Lloyd et al. (1990)

9.14 Key to the surface expression codes

1a. Topography of a surficial material is either bedrock-controlled or it reflects the surface configuration of the underlying surficial material; i.e., in either case, the surface material is draped over and owes its landform to the topography of an underlying substrate ..... **(2)**

2a. Thickness of the surficial material is relatively uniform over bedrock or surficial material ..... **(3)**

3a. Thickness of the surface material is less than about 1 m. See **VENEER (v)** and **THIN VENEER (x)**

3b. Thickness of surface material is greater than 1 m. See **BLANKET (b)**

2b. Thickness of surface material is variable, ranging from 0 to a few metres; surface material fills or partly fills depressions in an irregular substrate that may be either bedrock or surficial material. See **MANTLE OF VARIABLE THICKNESS (w)**

1b. There is no apparent relation between the topography of the surficial material and that of underlying bedrock or older surficial material; depositional or erosional landforms are present ..... **(4)**

4a. Simple, constructional or erosional landforms are present, consisting primarily of planar surfaces ..... **(5)**

5a. Slopes are between 0 and 3° (0–5%). See **PLAIN (p)**

5b. Slopes are between 4 and 15° (6–26%). See **GENTLE SLOPE (j)**

5c. Slopes are between 16 and 26° (27–49%). See **MODERATE SLOPE (a)**

5d. Slopes are between 27 and 35° (50–70%). See **MODERATELY STEEP SLOPE (k)**

5e. Slopes are steeper than 35° (70%). See **STEEP SLOPE (s)**

4b. More complex depositional or erosional landforms are present, consisting mainly of multi-directional, non-planar surfaces ..... **(6)**

6a. Non-linear rises and hollows with slopes generally less than 15° (26%). See **UNDULATING TOPOGRAPHY (u)**

6b. Elongate rises and hollows with slopes generally less than 15° (26%). See **ROLLING TOPOGRAPHY (m)**

6c. Non-linear rises and hollows with many slopes steeper than 15° (26%). See **HUMMOCKS (h)**

6d. Elongate rises with many slopes steeper than 15° (26%). See **RIDGES (r)**

6e. Hollows, separated from an adjacent gentler surface by a marked break of slope. See **DEPRESSIONS (d)**

6f. A fan shaped landform that is a sector of a cone: longitudinal gradient less than 15° (26%). See **FAN (f)**

6g. A fan shaped landform that is a sector of a cone; longitudinal gradient more than 15° (26%). See **CONE (c)**

6h. Level areas and scarps adjacent downslope. See **TERRACES (t)**

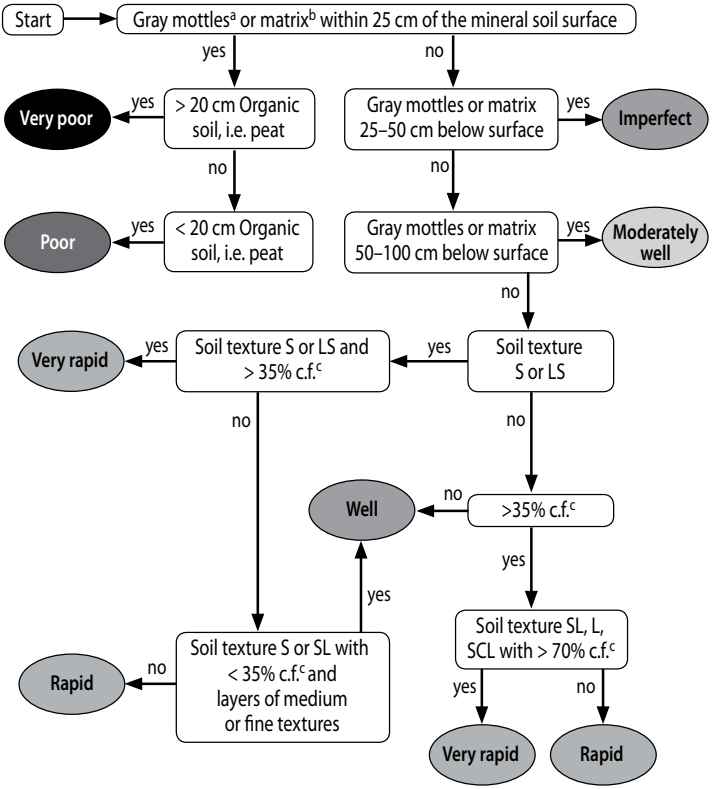
Application of Surface Expression

Surface Expression

Up to three surface expression terms may be used to describe the surface expression of a surficial material and are placed immediately after the surficial material symbol.
The use of two or three surface expression terms together implies that there is a mixing or juxtaposition of discrete forms and not a combination of intermediate forms.
When more than one surface expression term is used, the symbols are written in order of decreasing importance based on their areal extent.

For More Info: www.ilmb.gov.bc.ca/risc/pubs/teecolo/terclass/surface.htm#anchor663065

9.15 Soil drainage key



a Exclude mottles that are faint or few in number
b Exclude gray 'Ae' horizons
c Coarse fragment (c.f.) content by volume

Adapted from Minnesota Division of Forestry Ecological Land Classification Program 2006

9.16 Key to humus forms

1a. Well to imperfectly drained sites; humus form not saturated for prolonged periods

2a. Combined thickness of F and H horizons >2 cm if Ah <2 cm

3a. >50% thickness of F horizon(s) is Fm ..... **MORS (R)**

4a. Decaying wood >35% of organic matter volume in humus form profile ..... **Lignomor (LR)**

4b. Decaying wood ≤ 35% of organic matter volume in humus form profile

5a. F horizon >50% of thickness of F and H horizon ..... **Hemimor (HR)**

5b. Hh horizon >50% of thickness of F and H horizons.. **Humimor (UR)**

5c. Hr horizon >50% of thickness of F and H horizons .... **Resimor (RR)**

3b. F horizon(s) includes Fz and/or Fa ..... **MODERS (D)**

6a. Decaying wood >35% of organic matter volume in humus form profile ..... **Lignomoder (LD)**

6b. Decaying wood ≤35% of organic matter volume in humus form profile

7a. Fa horizon >50% of thickness of F horizons; or Fm horizon present..... **Mormoder (RD)**

7b. Fz horizon >50% of thickness of F horizons

8a. F and H horizons greater than or equal to thickness of Ah horizon..... **Leptomoder (TD)**

8b. F and H horizons less than thickness of Ah horizon ..... **Mullmoder (MD)**

2b. Combined thickness of F and H horizons ≤2 cm and Ah horizon ≥2cm... **MULLS (L)**

9a. Rhizogenous Ah horizon formed from decomposition of dense fine roots ..... **Rhizomull (ZL)**

9b. Zoogenous Ah horizon formed through actions of abundant earthworms..... **Vermimull (VL)**

1b. Poor to very poorly drained sites; humus form saturated for prolonged periods

10a. Combined thickness of F, H, and O horizons ≤2 cm and Ah horizon >2 cm ..... **Hydromull (YL)**

10b. Combined thickness of F, H, and O horizons >2 cm if Ah <2 cm

11a. Thickness of F and H horizons ≥O horizons

12a. F horizon(s) is Fm..... **Hydromor (YR)**

12b. F horizon(s) includes Fz and/or Fa ..... **Hydromoder (YD)**

11b. Combined thickness of O horizons greater than F and H horizons

13a. Of horizon >50% of thickness of O horizons ..... **Fibrimor (FR)**

13b. Om horizon ≥50% of thickness of O horizons ..... **Mesimor (MR)**

13c. Oh horizon >50% of thickness of O horizons..... **Saprimoder (SD)**

9.17 Key to soil Orders

Cryosol? Permafrost within 1 m of surface or within 2 m if strongly cryoturbated.

no

Organic? Soils composed largely of organic materials, meeting any of the following criteria:

- Of horizons at least 60 cm in depth over mineral soil; or
- Om, Oh, L, F, H horizons totaling at least 40 cm in depth over mineral soil; or
- >10 cm in total of L, F, and H horizons over bedrock or fragmental material;
- <20 cm of mineral soil over bedrock with overlying organic horizons > twice as thick
- mineral horizons within 40 cm of surface, with underlying organic horizons at least 40 cm thick, where organic material occupies >40 cm of the upper 80 cm.

no

Vertisol? Formed in heavy clay materials with shrink-swell characteristics. Both vertic and slickenside horizons present within 1 m of the mineral surface. Uncommon in B.C.

no

Podzol? Podzolic B horizon (Bf, Bhf, or Bh ≥10 cm) and no Bt within 50 cm of mineral surface.

no

Gleysol? Strong evidence of saturation with water and reducing conditions continuously or during prolonged periods based on one of the following indicators within 50 cm of the mineral surface:

- chromas ≤1 with no mottling (in hues less red than 5YR)
- chromas ≤2 (in hues of 10YR and 7.5YR) with prominent mottling
- chromas ≤3 (in hues yellower than 10YR) with prominent mottling
- hues bluer than 10Y with or without mottling
- in red soil materials (5YR or redder), distinct or prominent mottling.

no

Solonetz? Salt-affected soils with a Bn or Bnt horizon. Within B.C., occur primarily in poorly drained depressions in dry areas of the southern interior, and in saline parent materials in the Peace River region.

no

Chernozem? Dark-coloured Ah, Ahe, or Ap horizon ≥10 cm thick, enriched with organic matter from decomposed grass leaves and roots. Associated with grasslands and grassland-forest transitions under conditions of low rainfall, high summer temperatures, and high rates of evapotranspiration.

no

Luvisol? Bt horizon >5 cm thick anywhere in the profile.

no

Brunisol? Bm, Btj, or Bfj horizon ≥5 cm thick, or a Bf <10 cm thick.

no

Regosol Soil materials ≥10 cm in depth, but meeting none of the above criteria.

9.18 Key to soil Great Groups and Subgroups

Synopsis of criteria for classifying soils to the subgroup level

The following criteria and coding have been abstracted from the Canadian System of Soil Classification, Third Edition (1998), which should be consulted for more detailed information. In many cases, subgroup coding is followed by a commonly observed horizon sequence in which the diagnostic horizons have been underlined. Orders are arranged in alphabetical order.

Brunisol

Dystric Brunisol: Bm, Bfj, or Btj horizon ≥ 5 cm; pH < 5.5 throughout upper 25 cm of B horizon

- *Orthic Dystric Brunisol* (**O.DYB**) LFH, Bm, C
- *Eluviated Dystric Brunisol* (**E.DYB**) has an Ae horizon ≥ 2 cm thick
- *Duric Dystric Brunisol* (**DU.DYB**) LFH, Bm or Bfj, Bc or BCc, C (has a strongly cemented horizon that does not meet the criteria of a podzolic B horizon)
- *Gleyed Dystric Brunisol* (**GL.DYB**) has faint–distinct mottling within 50 cm of surface or distinct–prominent mottling at depths of 50–100 cm
- *Gleyed Eluviated Dystric Brunisol* (**GLE.DYB**) has an Ae ≥ 2 cm thick and faint–distinct mottling within 50 cm of surface or distinct–prominent mottling at depths of 50–100 cm

Eutric Brunisol: Bm or Btj horizon ≥ 5 cm; pH ≥ 5.5 anywhere in upper 25 cm of B horizon

- *Orthic Eutric Brunisol* (**O.EB**) LFH, Bm, Ck or C

* Other subgroups are analogous to those listed for Dystric Brunisol, except there is no Duric subgroup

Sombric Brunisol: Ah ≥ 10 cm and pH < 5.5 throughout upper 25 cm of B horizon

- *Orthic Sombric Brunisol* (**O.SB**) LFH, Ah, Bm,C

* Other subgroups are analogous to those listed for Dystric Brunisol

Melanic Brunisol: Ah ≥ 10 cm and pH ≥ 5.5 anywhere in upper 25 cm of B horizon

- *Orthic Melanic Brunisol* (**O.MB**) LF, Ah, Bm, Ck or C (C often calcareous)

* Other subgroups are analogous to those listed for Dystric Brunisol, except there is no Duric subgroup

Chernozem

Brown Chernozem: Sub-arid–semi-arid soil climate; assoc. with xerophytic and mesophytic grasses and forbs; brownish Ah horizon with color values < 3.5 moist and 4.5–5.5 dry, and chroma > 1.5 dry

- *Orthic Brown Chernozem* (**O.BC**) Ah, Bm, Cca or Ck
- *Rego Brown Chern.* (**R.BC**) Ah, Cca or Ck (lack a B horizon ≥ 5 cm thick)

- *Calcareous Brown Chern.* (**C.BC**) Ah, Bmk, Cca or Ck (presence of carbonates in Bmk indicated by effervescence when 10% HCl is added)
- *Eluviated Brown Chern.* (**E.BC**) Ah, Ae, Btj or Bt, Cca or Ck
- *Solonetzic Brown Chern.* (**SZ.BC**) Ah, Ae, Btnj or Btjnj, Csa or Ck (grading to Solonetzic order)
- *Vertic Brown Chern.* (**V.BC**) grading to Vertisol; *rare in B.C.*

**Gleyed subgroups have faint-distinct mottling within 50 cm of mineral surface:

- *Gleyed Brown Chern.* (**GL.BC**) Ah, Bmgj, Ckgj
- *Gleyed Rego Brown Chern.* (**GLR.BC**) Ah, Ckgj
- *Gleyed Calcareous Brown Chern.* (**GLC.BC**) Ah,Bmkgj, Ckgj
- *Gleyed Eluviated Brown Chern.* (**GLE.BC**) Ah, Aej, Btjgj or Btgj, Ckgj
- *Gleyed Solonetzic Brown Chern.* (**GLSZ.BC**) Ah, Ae, Bnjtjgj, Csagj
- *Gleyed Vertic Brown Chern.* (**GLV.GL**) grading to Vertisol; very rare in B.C.

Dark Brown Chernozem: Semi-arid soil climate; assoc. with mesophytic grasses and forbs. Darker brownish Ah horizon with color values < 3.5 moist and 3.5–4.5 dry, and chroma > 1.5 dry

- Subgroups are analogous to those listed for the Brown Chernozem great group.

Black Chernozem: Sub-humid soil climate; assoc. with mixed mesophytic grasses and forbs, sometimes with tree cover, may occur under alpine grasses and shrubs; Ah darker in color and tends to be thicker than in other great groups, with color value < 3.5 moist and dry, and chroma ≤ 1.5 dry

- Subgroups are analogous to those listed for the Brown Chernozem great group.

Dark Gray Chernozem: Sub-humid climate; assoc. with forest–grassland transition zones; have Ahe horizon indicating eluviation; usually have forest floor horizons overlying the Ah

- *Orthic Dark Gray Chernozem* (**O.DGC**) Ahe, Ae, Bm or Btj or Bt, Cca or Ck

* Other subgroups have an Ahe horizon, but are otherwise analogous to those listed for the Brown Chernozem great group, except there are no eluviated subgroups.

Cryosol

Turbic Cryosol: Primarily mineral material; permafrost within 2 m of surface; cryoturbation indicated by disrupted, mixed, or broken horizons, displaced material; usually in patterned ground

- Eutric subgroups have pH ≥ 5.5 in some part of B horizons
- Dystric subgroups have pH < 5.5 throughout B horizons
- Brunisolic subgroups have a a Bm horizon ≥ 10 cm thick; others may have a Bm <10 cm
- Gleysolic subgroups have strongly gleyed horizons assoc. with poor drainage, reducing conditions.

- Histic subgroups have a continuous Bm or Bmy in the upper part of the profile, and either a continuous surface organic horizon ranging from >15–40 cm thick, or a combination of surface and subsurface organic horizons > 15 cm thick within 1 m of surface.

- *Orthic Eutric Turbic Cry*. (**OE.TC**) Om, Bmy , BCy, Cgy, Omy, Cz
- *Orthic Dystric Turbic Cry*. (**OD.TC**) horizons as above, pH < 5.5 in B horizon
- *Brunisolic Eutric Turbic Cry*. (**BRE.TC**) Om, Bm, Bmy or BCy, Cgy, Omy, Cz
- *Brunisolic Dystric Turbic Cryosol* **(BRD.TC)** horizons as above, pH < 5.5
- *GleysolicTurbic Cryosol* (**GL.TC**) Om, Bgy or Cgy (or both), Cz
- *Regosolic Turbic Cryosol* (**R.TC**) Om, Cy, Cgy,Cz
- *Histic Eutric Turbic Cryosol* (**HE.TC**) Om, Ah, Bmy or Bm (or both) or Cgy, Cz
- *Histic Dystric Turbic Cryosol* (**HD.TC**) horizon sequence as above, pH < 5.5
- *Histic Regosolic Turbic Cryosol* (**HR.TC**) Om, Cy, Cgy, Cz

Static Cryosol: Permafrost within 1 m of surface but lacking strong evidence of cryoturbation; formed in coarse-textured mineral parent materials or in any recently deposited or disturbed sediments; may have surface organic horizons < 40 cm thick

- *Orthic Eutric Static Cryosol* (**OE.SC**) Om, LFH, Bm, BCgj, Cz

* Other subgroups are analogous to those for Turbic Cryosols, but lack cryoturbated (y) horizons, and include one additional subgroup:

- *Luvisolic Static Cryosol* (**L.SC**) LFH, Om, Ah, or Ae, Bt, Cg, Cz (occur in fine-textured materials under forest vegetation; Bt ≥ 10 cm thick)

Organic Cryosol: Primarily organic material; permafrost within 1 m of surface; > 40 cm thick or > 10 cm thick over a lithic contact or an ice layer ≥ 30 thick

- Fibric, Mesic, and Humic subgroups have organic layers > 1 m thick, and are composed predominantly of fibric (Of), mesic (Om), and humic (Oh) horizons, respectively, below a depth of 40 cm.

- *Fibric Organic Cryosol* (**F.OC)** Of or Om, Of, Ofz
- *Mesic Organic Cryosol* (**M.OC**) Of or Om, Om, Omz
- *Humic Organic Cryosol* (**H.OC**) Oh or Om, Om, Ohz

- Terric subgroups have a mineral contact ≤ 1 m from the surface, or a mineral layer > 30 cm thick < 1 m from surface. Terric Fibric, Mesic, and Humic subgroups are composed predominantly of fibric (Of), mesic (Om), and humic (Oh) horizons, respectively, above the mineral contact.

- *Terric Fibric Organic Cryosol* (**TF.OC)** Of, Ofz, Cz
- *Terric Mesic Organic Cryosol* (**TM.OC**) Om, Omz, Cz
- *Terric Humic Organic Cryosol* (**TH.OC**) Oh, Ohz, Cz

- The Glacic subgroup has a layer of ground ice > 30 cm thick with an upper boundary < 1 m from the surface; the ice layer contains more than 95% ice by volume.

- *Glacic Organic Cryosol* (**GC.OC**) Of, Om or Oh, Wz

Gleysol

Gleysolic Great Group: no Ah or Ah < 10 cm thick, no Bt or Btg horizon

- *Orthic Gleysol* (**O.G**) LFH or O, Bg, Cg
- *Fera Gleysol* (**FE.G**) has a Bgf horizon ≥ 5 cm thick
- *Rego Gleysol* (**R.G**) LFH or O, Cg (lack a B horizon ≥ 5 cm thick)

Humic Gleysol: Ah horizon ≥ 10 cm thick; no Bt

- *Orthic Humic Gleysol* (**O.HG**) LFH or O, Ah, Bg, Cg
- *Rego Humic Gleysol* (**RE.HG**) LFH or O Ah, Cg

Luvic Gleysol: Btg horizon

- *Orthic Luvic Gleysol* (**O.LG**) LFH or O, Aeg, Btg, Cg
- *Humic Luvic Gleysol* (**HU.LG**) LFH or O, Ah, Aeg, Btg, Cg (Ah≥ 10 cm)
- *Fera Luvic Gleysol* (**FE.LG**) LFH or O, Ah, Aeg, Bgf, Btg, Cg (Bgf ≥ 10 cm)
- *Fragic Luvic Gleysol* (**FR.LG**) has a fragipan (Btgx or Bgx) within or below Bt horizon

Luvisol

Gray Luvisol: Mean annual soil temp. < 8 deg C; *predominant great group of Luvisols within B.C.*

- *Orthic Gray Luvisol* (**O.GL**) LFH Ae, (AB), Bt, BC or C
- *Dark Gray Luvisol* (**D.GL**) also has an Ah or Ahe horizon ≥ 5 cm thick
- *Brunisolic Gray Luvisol* (**BR.GL**) has a Bm horizon ≥ 5 cm (or Bf < 10 cm) over the Bt
- *Podzolic Gray Luvisol* (**PZ.GL**) has a Bf horizon ≥ 10 cm and Bt horizon above 50 cm depth
- *Fragic Gray Luvisol* (**FR.GL**) has a fragipan (Btx or BCx) within or below the Bt
- *Solonetzic Gray Luvisol* (**GSZ.GL**) has a Btnj horizon indicating an intergrade to the Solonetzic order
- *Vertic Gray Luvisol* (**V.GL**) Btss or Ckss horizon within 1 m of mineral surface, may have a Btvj

**Gleyed subgroups have distinct mottling within 50 cm of mineral surface or prominent mottling at 50–100 cm:

- *Gleyed Gray Luvisol* (**GL.GL**) LFH Ae, Btg, Cg
- *Gleyed Dark Gray Luvisol* (**GLD.GL**) Ah or Ahe ≥ 5 cm thick
- *Gleyed Brunisolic Gray Luvisol* (**GBR.GL**) Bm horizon ≥ 5 cm or Bf < 10 cm
- *Gleyed Podzolic Gray Luvisol* (**GPZ.GL**) Bf horizon ≥ 10 cm
- *Gleyed Fragic Gray Luvisol* (**GFR.GL**) fragipan within or below the Bt
- *Gleyed Solonetzic Gray Luvisol* (**GSZ.GL**) Btnjgj horizon
- *Gleyed Vertic Gray Luvisol* (**GV.GL**) Btgjss or Ckgjss horizon within 1 m of mineral surface, may have a Btgjvj

Gray Brown Luvisol: Mild, humid climatic conditions: mean annual soil temp > 8 deg C; forest mull Ah horizon or dark Ap horizon > 5 cm thick; often formed on calcareous parent materials; *within BwCwfound only in parts of the lower Fraser Valley*.

- *Orthic Gray Brown Luvisol* (**O.GBL**) Ah, Ae, Bt, Ck

* Subgroups analogous to those for Gray Luvisols, without Dark Gray or Fragic subgroups

Organic

*For wetland organic soils, the control section (upper 160 cm) is divided into three tiers: surface (0–40 cm), middle (40–120 cm), and bottom (120–160 cm). Classification is based primarily on the properties of the middle tier.

Fibrisol: Composed largely of relatively undecomposed fibric organic material (Of horizons – classes 1-4 on the von Post scale); occur extensively as peat deposits dominated by sphagnum mosses; have a dominantly fibric middle tier, or middle and surface tiers if a terric, lithic, or hydric contact occurs in the middle tier.

- *Typic Fibrisol* (**TY.F**) Of or Om, Of (middle and bottom tiers, if present, are predominantly fibric material (Of); there is no humic (Oh) layer > 12 cm thick or mesic (Om) layer > 25 cm in the middle or bottom tier, or, if a lithic contact occurs in the middle tier, no such layers are found in the middle or surface tiers)
- *Mesic Fibrisol* (**ME.F**) Of or Om, Of, Om, Of (has a subdominant mesic layer > 25 cm thick in the middle or bottom tier; lacks terric, cumulic, hydric, or limnic layers)
- *Humic Fibrisol* (**HU.F**) Of, Om or Oh, Of, Oh, Of or Om (has a subdominant humic layer > 12 cm thick in the middle or bottom tier; may have a subdominant mesic layer, but lacks terric, cumulic, hydric, or limnic layers)
- *Limnic Fibrisol* (**LM.F**) Of or Om, Of, Oco (limnic layer beneath the surface tier, comprised of coprogenous earth (sedimentary peat), diatomaceous earth, or marl ≥ 5 cm thick; may have mesic, humic, or cumulic layers, but lack terric or hydric layers)
- *Cumulic Fibrisol* (**CU.F**) Of or Om, Of, C,Of (cumulic layer beneath the surface tier, consisting either of multiple layers of mineral material (alluvium) ≥ 5 cm thick in total, or of one layer 5–30 cm thick; may have fibric or humic layers, but lack terric, hydric, and limnic layers)
- *Terric Fibrisol* (**T.F**) Of or Om, Of, C (terric layer of unconsolidated mineral soil ≥ 30 cm thick beneath the surface tier; may have cumulic or limnic layers, but lacks mesic, humic, or hydric layers)

- *Terric Mesic Fibrisol* (**TME.F**) Of or Om, Of, Om, C (both a terric layer beneath the surface tier and a subdominant mesic layer > 25 cm thick in the control section; may have mesic, cumulic, or limnic layers , but lacks a hydric layer)
- *Terric Humic Fibrisol* (**THU.F**) Of or Om, Of, Oh, C (both a terric layer beneath the surface tier and a subdominant humic layer > 12 cm thick in the control section; may have mesic, cumulic, or limnic layers , but lacks a hydric layer)
- *Hydric Fibrisol* (**HY.F**) Of or Om, Of, W (has a layer of water extending from a depth of ≥ 40 cm to > 1.6 m; may have mesic, humic, cumulic, terric, or limnic layers)

Mesisol: Organic soils predominantly at an intermediate (mesic) stage of decomposition (mainly Om horizons – class 5 or 6 on von Post scale); middle tier is dominantly mesic; if a terric, lithic, or hydric contact occurs in the middle tier, both surface and middle tiers must be dominantly mesic.

- *Typic Mesisol* (**TY.M**) Of, Om or Oh, Om (lack subdominant humic or fibric layers with a total thickness > 25 cm in the middle and bottom tiers or in the middle and surface tiers if a lithic contact occurs in the middle tier
- *Fibric Mesisol* (**FI.M**) Of, Om or Oh, Om, Of, Om (has a subdominant fibric layer > 25 cm in the middle or bottom tiers; no humic layer > 25 cm)
- *Humic Mesisol* (**HU.M**) Of, Om or Oh, Om, Oh, Om (has a subdominant humic layer > 25 cm thick in the middle or bottom tiers; may have a subdominant fibric layer)
- *Terric Fibric Mesisol* (**TFI.M**) Of, Om or Oh, Om , Of, C, Om (both a terric layer ≥ 30 cm thick beneath the surface tier and a subdominant fibric layer > 25 cm; may have cumulic and limic layers but lack humic and hydric layers)
- *Terric Humic Mesisol* (**THU.M**) Of, Om or Oh, Om, Oh, C, Om (both a terric layer ≥ 30 cm thick beneath the surface tier and a subdominant humic layer > 25 cm; may have fibric, cumulic or limic layers but lack a hydric layer)

* Other Mesisol subgroups are analogous to those in the Fibrisol great group, including: *Limnic Mesisol* (**LM.M**), *Cumulic Mesisol* (**CU.M**), *Terric Mesisol* (**T.M)**, and *Hydric Mesisol* (**HY.M**)

Humisol: Composed predominantly of well-decomposed organic materials (Oh horizons – mostly class 7 or higher on the von Post scale); have a dominantly humic middle tier or middle and surface tiers if a terric, lithic, or hydric contact occurs in the middle tier; *only minor areas of Humisols are known to occur in Canada*.

- *Typic Humisol* (**TY.H**) Om or Oh, Oh (middle and bottom tiers, if present, are dominantly humic; have neither fibric layers > 12 cm or mesic layers > 25 cm thick in the middle or bottom tiers, or in the middle and surface tiers if a lithic contact occurs in the middle tier)

- *Fibric Humisol* (**FI.H**) Om or Oh, Oh, Of, Oh (has a subdominant fibric layer > 12 cm in the middle or bottom tiers; may have a subdominant mesic layer)
- *Mesic* Humisol (**ME.H**) Om or Oh, Oh, Om, Oh (has a subdominant mesic layer > 25 cm thick in the middle or bottom tiers; lacks a subdominant fibric layer below the surface tier)
- *Terric Fibric Humisol* (**TFI.H**) Of or Oh, Oh, Of, C, Oh (has both a terric layer ≥30 cm thick beneath the surface tier, and a subdominant fibric layer > 12 cm thick within the control section; may also have mesic, cumulic or limnic layers , but lack a hydric layer)
- *Terric Mesic Humisol* (**TME.H**) Om or Oh, Oh, Om, C, Oh (has both a terric layer ≥30 cm thick beneath the surface tier and a subdominant mesic layer thicker than 25 cm within the control section; may have cumulic or limnic layers but lack a subdominant fibric or hydric layer)
- *Other Humisol subgroups are analogous to those in the Fibrisol great group, including: Limnic Humisol* (**LM.H**), *Cumulic Humisol* (**CU.H**), *Terric Humisol* (**T.H**), and *Hydric Humisol* (**HY.H**)

Folisol: Well to imperfectly drained upland organic soils composed predominantly of L, F, and H horizons; must be either ≥ 40 cm thick, or ≥ 10 cm thick if overlying bedrock or fragmental material, or more than twice the thickness of an underlying mineral soil layer that is < 20 cm thick. In the following horizon sequences, "M" stands for "mineral soil horizons".

- *Hemic Folisol* (**HE.FO**) L, F, H, O, R, (M) (mainly composed of F horizons; may have subdominant H and O horizons, each < 10 cm thick; commonly have a lithic contact or fragmental layers)
- *Humic Folisol* (**HU.FO**) L, F. H, O, R, (M) (mainly composed of H horizons; may have subdominant F and O horizons each < 10 cm thick; may have a lithic contact, fragmental, or mineral layers may be common in the control section; occur most frequently in cool, moist, humid forest ecosystems)
- *Lignic Folisol* (**LI.FO**) L, F,H R, (M) (dominated by F or H horizons composed primarily of moderately to well-decomposed woody materials occupying more than 30% of the surface area of the F and H horizons)
- *Histic Folisol* (**HI.FO**) L, F, H, O, R, (M) (dominated by F or H horizons directly underlain by an O horizon ≥ 10 cm thick)

Podzol

Ferro-Humic Podzol: Bhf horizon ≥ 10 cm thick

- *Orthic Ferro-Humic Podzol* (**O.FHP**) LFH or O, Ae, Bhf, Bf, BC, C
- *Luvisolic Ferro-Humic Podzol* (**LU. FHP**) also has a Bt horizon > 50 cm from surface
- *Sombric Ferro-Humic Podzol* (**SM.FHP**) also has an Ah horizon ≥ 10 cm thick

- *Gleyed Ferro-Humic Podzol* (**GL. FHP**) also has distinct or prominent mottles (gleying) within 1m
- *Gleyed Sombric Ferro-Humic Podzol* (**GLSM.FHP**) Ah ≥ 10 cm and evidence of gleying within 1m

- Subgroups of FHP's with cemented horizons present in addition to a Bhf horizon ≥ 10 cm:

- *Ortstein Ferro-Humic Podzol* (**OT.FHP**) strongly cemented Bfc or Bhfc horizon
- *Gleyed Ortstein Ferro-Humic Podzol* (**GLOT.FHP**) Bhf, and Bfc or Bhfc and gleying within 1 m
- *Placic Ferro-Humic Podzol* (**P.FHP**) a thin hard, often vitreous cemented layer (Bfc or Bhfc horizon)
- *Duric Ferro-Humic Podzol* (**DU.FHP**) cemented horizon that is not podzolic (BCc)
- *Fragic Ferro-Humic Podzol* (**FR. FHP**) fragipan horizon (Bx or BCx)

Humo-Ferric Podzol: Bf or Bf + Bhf horizons ≥ 10 cm; no Bhf horizon ≥ 10 cm

- *Orthic Humo-Ferric Podzol* (**O.HFP**) LFH, Ae, Bf, BC, C

* Other subgroups are analogous to those listed for Ferro-Humic Podzols

Humic Podzol: Bh horizon ≥ 10 cm thick; usually have gleyed horizons; *uncommon in B.C.*

- *Orthic Humic Podzol* (**O. HP**) O or LFH, Ae, Bh, Bfgj, BCgj, Cg

* Other subgroups: Ortstein, Placic, Duric, and Fragic, as described under Ferro-Humic Podzols

Regosol

Regosol great group: Ah absent or < 10 cm thick

- *Orthic Regosol* (**O.R**) C (Ah absent or < 10 cm, Bm absent or < 5 cm)
- *Cumulic Regosol* (**CU.R**) C, Ahb, C (usually due to intermittent flooding)
- *Gleyed Regosol* (**GL.R**) faint–distinct mottling within 50 cm of the mineral surface
- *Gleyed Cumulic Regosol* (**GLCU.R**) Cgj, Ahb, Cgj (buried Ah and faint–distinct mottling within 50 cm of the mineral surface)

Humic Regosol: Ah ≥ 10 cm thick

- *Orthic Humic Regosol* (**O.HR**) Ah, C (Ah horizon ≥ 10 cm thick)

* Other subgroups are analogous to those listed under Regosol Great Group

Solonetz

Solonetz great group: hard, massive Bn or Bnt horizon; lack a well-developed Ae; abrupt boundary between A and B horizons

- *Brown Solonetz* (**B.SZ**) Ah, Bn or Bnt, Csk (sub-arid–semi-arid climate; Ah color value > 4.5 dry)

- *Dark Brown Solonetz* (**DB.SZ**) Ah, Bn or Bnt, Csk (semi-arid climate; Ah color value 3.5-4.5 dry)
- *Black Solonetz* (**BL.SZ**) Ah, Bnt, Csk (sub-humid climate; Ah color value < 3.5 wet or dry)
- *Alkaline* Solonetz (**A.SZ**) Ah, Bn, Csk (pH of A horizon ≥ 8.5)

** Gleyed subgroups are as above but have faint-distinct mottling within 50 cm of surface:

- *Gleyed Brown Solonetz* (**GLB.SZ**) Ah, Bngj, Cskgj
- *Gleyed Dark Brown Solonetz* (**GLDB.SZ**) Ah, Bngj, Cskgj
- *Gleyed Black Solonetz* (**GLBL.SZ**) Ah, Bntgj, Cskgj

Solodized Solonetz: columnar Bn or Bnt horizon; Ae ≥ 2 cm; abrupt boundary between A and B horizons.

- *Brown Solodized Solonetz* (**B.SS**) : Ah, Ae, Bn or Bnt, Csk

* Subgroups are mostly analogous to those listed for the Solonetz great group, but include an Ae horizon in addition to an Ah. There is no Alkaline subgroup, but there are four additional subgroups as follows:

- *Dark Gray Solodized Solonetz* (**B.SZ**) Ahe, Ae, Bnt, Csk
- *Gray Solodized Solonetz* (**DB.SZ**) Ahe, Ae, Bnt, Csk
- *Gleyed Dark Gray Solodized Solonetz* (**B.SZ**) Ah, Aegj, Bngj or Bntgj, Cskgj
- *Gleyed Gray Solodized Solonetz* (**DB.SZ**) Ah, Aegj, Bntgj, Cskgj

Solod: In addition to an Ae ≥ 2 cm, have an AB horizon due to degradation of the upper Bn horizon; no strong columnar structure in Bn.

- *Brown Solod* (**B.SO**) Ah, Ae, AB, Bnt, Ck, Csk

* Other subgroups are analogous to those listed for the Solodized Solonetz great group, but have an AB horizon in addition to the Ah or Ahe and Ae horizons

Vertic Solonetz: intergrading to Vertisol order; slickenside horizon < 1 m from surface; may have a weak vertic horizon (Bnvj or Bntvj).

- *Brown Vertic Solonetz* (**BV.SZ**) Ah, Ae or AB, Bn or Bnt, Bnvj or Bntvj, Bnss or Bntss or Cskss, Csk

* Other subgroups are analogous to those listed for the Solonetz great group, but have in addition the following horizons: Bnvj or Bntvj, Bnss or Bntss or Cskss

Vertisol

Vertisol great group: Ah absent or < 10 cm thick; a vertic (Bv or Bvk) and a slickenside (ss) horizon within the top 1 m of the soil surface.

- *Orthic Vertisol* (**O.V**) Ah, Bv or Bvk, Bss or Bssk or Ckss, Ck
- *Gleyed Vertisol* (**GL.V**) faint–distinct mottling within 50 cm of the mineral surface
- *Gleysolic Vertisol* (**GLC.V**) colors that indicate poor drainage or prominent mottling within 50 cm of the mineral surface)

Humic Vertisol great group: Ah ≥ 10 cm thick, otherwise as for Vertisol great group

- *Orthic Humic Vertisol* (**O.HV**) Ah, Bv or Bvk, Bss or Bssk or Ckss, Ck

* Other subgroups are analogous to those listed under Vertisol great group

NOTES

9.19 Soil texture key

Determining Soil Texture

Soil texture refers to the relative proportions of sand, silt, and clay separates within a soil. These separates have their own distinctive properties of "feel," allowing one to estimate their proportions in a sample of soil by hand texturing. To obtain accurate results, texturing must be done with a sample that has the correct moisture content. Both a table and a key procedure are provided. The user should become familiar with both methods and use the procedure that feels most comfortable.

Procedure for Hand Texturing

1. Crush a small handful of soil in the hand, and remove coarse fragments (particles >2 mm in diameter).
2. Gradually add water to the soil and, with a soil knife or fingers, work it into moist putty. The correct moisture content is important. If the putty flows with the force of gravity, it is too wet. If it crumbles when rolled, it is too dry. It should have the consistency of filler putty.
3. Determine stickiness of the soil putty by working it between the thumb and forefinger, pressing and then separating the digits. An estimate of clay content (Table 5.5) can be made in this way. (Clay limits below are approximate.)
   non-sticky: Practically no soil material adheres to the thumb and forefinger (<10% clay).
   slightly sticky: Soil material adheres to only one of the digits and comes off the other rather cleanly. The soil does not stretch appreciably when digits are separated (10–25% clay).
   sticky: Soil material adheres to both digits and stretches slightly before breaking when digits are pulled apart (25–40% clay).
   very sticky: Soil material adheres strongly to both digits and stretches distinctly before breaking (>40% clay).
4. Determine the graininess of the soil putty by rubbing it between thumb and forefinger. An estimate of sand content (Table 5.5) can be made in this way. (Sand limits below are approximate.)
   non-grainy: Little or no graininess can be felt (<20% sand).
   slightly grainy: Some graininess is felt, but non-grainy material (silt and clay) is dominant (20–50% sand).
   grainy: Sand is felt as the dominant material. Some non-grainy material can be felt between sand grains (50–80% sand).
   very grainy: Sand is the only material felt. Little or no non-grainy material is present (>80% sand).

After stickiness and graininess have been determined, use the hand texturing guide as an approximate guide to the textural class of the soil. The textural triangle can be used for more accurately determining the textural class; it also displays the textural class used in the site unit descriptions.

Hand texturing guide [a]

	Non-grainy (<20% sand)	**Slightly grainy** (20–50% sand)	**Grainy** (50–80% sand)	**Very grainy** (>80% sand)
Very sticky (>40% clay)	Silty clay	Clay	Sandy clay	–
Sticky (25–40% clay)	Silty clay loam	Clay loam	Sandy clay loam	–
Slightly sticky (10–25% clay)	Silt loam or silt	Loam [b]	Sandy loam	–
Non-sticky (<10% clay)	–	–	–	Loamy sand or sand

a Sand and clay limits are approximate.

b Loams contain balanced proportions of sand, silt and clay and exhibit physical properties intermediate between them.

Properties of soil separates

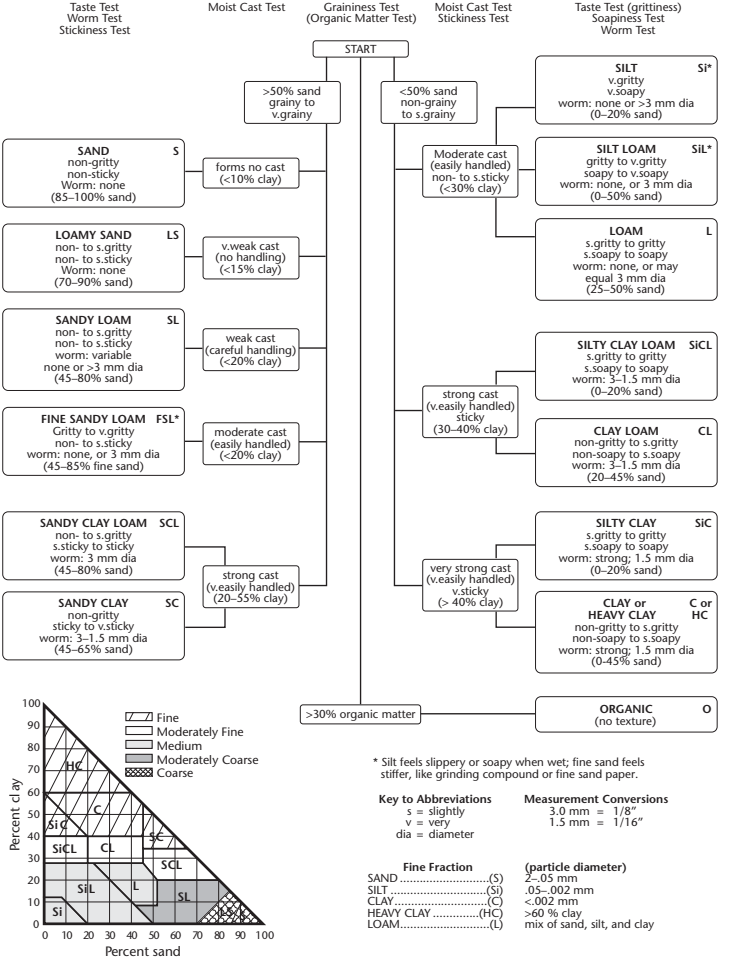
Properties of fine fraction	
Clay:	– very hard when dry; feels smooth and is very sticky when wet; feels smooth when placed between teeth.
Silt:	– slightly hard to soft when dry; powder is floury when dry; feels slippery or soapy and only slightly sticky or non-sticky when wet; silt cannot be felt as grains between thumb and forefinger, but can be felt as a fine grittiness when placed between teeth.
Sand:	– loose grains when dry; very grainy when felt between thumb and forefinger; non-sticky when wet.

Procedure for Using Key for Hand Texturing

The field tests (outlined below and used in sequence with the accompanying key) are provided as another means to assist in the field determination of soil texture.

1. Organic matter test: Well-decomposed organic matter (humus) imparts silt-like properties to the soil. It feels floury when dry and slippery or spongy when moist, but not sticky and not plastic. However, when subjected to a taste test (see below), it feels non-gritty. It is generally very dark when moist or wet, and stains the hands brown or black.
2. Graininess test: Rub the soil between your fingers. If sand is present, it will feel "grainy." Determine whether sand comprises more or less than 50% of the sample. Sandy soils often sound abrasive when worked in the hand.
3. Moist cast test: Compress some moist (not wet) soil by clenching it in your hand. If the soil holds together (i.e., forms a "cast"), then test the durability of the cast by tossing it from hand to hand. The more durable it is (e.g., like Plasticine), the more clay is present.
4. Stickiness test: Wet the soil thoroughly and compress between thumb and forefinger. Determine the degree of stickiness by noting how strongly the soil adheres to the thumb and forefinger when you release the pressure, and by how much it stretches. Stickiness increases with clay content.
5. Taste test: Work a small amount of soil between your front teeth. Silt particles are distinguished as fine "grittiness" (e.g., like driving on a dusty road), unlike sand, which is distinguished as individual grains (i.e., graininess). Clay has absolutely no grittiness.
6. Soapiness test: Slide thumb and forefinger over wet soil. Degree of soapiness is determined by how soapy/slippery it feels and how much resistance to slip there is (i.e., from clay and sand particles).
7. Worm test: Roll some moist soil on your palm with your finger to form the longest, thinnest "worm" possible. The more clay there is in the soil, the longer, thinner, and more durable the worm will be. Try with wetter or drier soil to ensure that you have the correct moisture content (best worm).

Soil Texturing Key



* Silt feels slippery or soapy when wet; fine sand feels stiffer, like grinding compound or fine sand paper.

Key to Abbreviations
s = slightly
v = very
dia = diameter

Measurement Conversions
3.0 mm = 1/8"
1.5 mm = 1/16"

Fine Fraction **(particle diameter)**
SAND .....(S) 2–.05 mm
SILT .....(Si) .05–.002 mm
CLAY .....(C) <.002 mm
HEAVY CLAY .....(HC) >60 % clay
LOAM.....(L) mix of sand, silt, and clay

9.20 Tree species codes[1,2] Version 4.5

Native Conifers

Cedar	***Thuja***	**C**
western redcedar	*Thuja plicata*	Cw
Cypress	***Chamaecyparis***	**Y**
yellow-cedar	*C. nootkatensis*	Yc
Douglas-fir	***Pseudotsuga***	**F**
Douglas-fir	*P. menziesii*	Fd
coastal Douglas-fir	*P. menziesii* var. *menziesii*	Fdc
interior Douglas-fir	*P. menziesii* var. *glauca*	Fdi
Fir (Balsam)	***Abies***	**B**
amabilis fir	*A. amabilis*	Ba
grand fir	*A. grandis*	Bg
subalpine fir	*A. lasiocarpa*	Bl
Hemlock	***Tsuga***	**H**
mountain hemlock	*T. mertensiana*	Hm
western hemlock	*T. heterophylla*	Hw
mountain x western hemlock hybrid	*T. mertensiana* x *heterophylla*	Hxm
Juniper	***Juniperus***	**J**
Rocky Mtn. juniper	*J. scopulorum*	Jr
seaside juniper	*J. maritima*	Js
Larch	***Larix***	**L**
alpine larch	*L. lyallii*	La
tamarack	*L. laricina*	Lt
western larch	*L. occidentalis*	Lw
Pine	***Pinus***	**P**
jack pine	*P. banksiana*	Pj
limber pine	*P. flexilis*	Pf
lodgepole pine	*P. contorta*	Pl
lodgepole pine	*P. contorta* var. *latifolia*	Pli
lodgepole x jack pine hybrid	*P.* x *murraybanksiana*	Pxj
ponderosa pine	*P. ponderosa*	Py
shore pine	*P. contorta* var. *contorta*	Plc
western white pine	*P. monticola*	Pw
whitebark pine	*P. albicaulis*	Pa

1 Data Custodian: Director, Research Branch, B.C. Ministry of Forests.
2 Trees are defined as being woody, single stemmed, and capable of growing to greater than 10 m in height.

Spruce	***Picea***	**S**
black spruce	*P. mariana*	Sb
Engelmann spruce	*P. engelmannii*	Se
Sitka spruce	*P. sitchensis*	Ss
white spruce	*P. glauca*	Sw
spruce hybrid	*Picea* cross	Sx
Engelmann x white	*P. engelmannii* x *glauca*	Sxw
Sitka x white	*P.* x *lutzii*	Sxl
Sitka x unknown hybrid	*P. sitchensis* x *?*	Sxs
Yew	***Taxus***	**T**
western yew	*Taxus brevifolia*	Tw

Native Hardwoods

Alder	***Alnus***	**D**
red alder	*A. rubra*	Dr
Apple	***Malus***	**U**
Pacific crab apple	*Malus fusca*	Up
Aspen, Cottonwood, or Poplar	***Populus***	**A**
poplar	*P. balsamifera*	Ac
balsam poplar	*P. b.* ssp. *balsamifera*	Acb
black cottonwood	*P. b.* ssp. *trichocarpa*	Act
hybrid poplars	*P.* sp. x *P.* sp.	Ax
trembling aspen	*P. tremuloides*	At
Arbutus	***Arbutus***	**R**
Arbutus	*Arbutus menziesii*	Ra
Birch	***Betula***	**E**
Alaska paper birch	*B. neoalaskana*	Ea
Alaska x paper birch hybrid	*B.* x *winteri*	Exp
paper birch	*B. papyrifera*	Ep
water birch	*B. occidentalis*	Ew
Cascara	***Rhamnus***	**K**
cascara	*R. purshiana*	Kc
Cherry	***Prunus***	**V**
bitter cherry	*P. emarginata*	Vb
choke cherry	*P. virginiana*	Vv
pin cherry	*P. pensylvanica*	Vp
Dogwood	***Cornus***	**G**
Pacific dogwood	*Cornus nuttallii*	Gp

Maple	***Acer***	**M**
bigleaf maple	*A. macrophyllum*	Mb
vine maple	*A. circinatum*	Mv
Oak	***Quercus***	**Q**
Garry oak	*Q. garryana*	Qg
Willow	***Salix* spp.**	**W**
Bebb's willow	*S. bebbiana*	Wb
Pacific willow	*S. lucida*	Wp
peachleaf willow	*S. amygdaloides*	Wa
pussy willow	*S. discolor*	Wd
Scouler's willow	*S. scouleriana*	Ws
Sitka willow	*S. sitchensis*	Wt

Unknowns

Unknown	**X**
Unknown conifer	Xc
Unknown hardwood	Xh

Others

Other tree, not on list	**Z**
Other conifer	Zc
Other hardwood	Zh

Exotics [1]

Apple	***Malus***	**U**
apple	*Malus pumila*	Ua
Aspen, Cottonwood, or Poplar	***Populus***	**A**
* southern cottonwood	*P. deltoides*	Ad
Birch	***Betula***	**E**
European birch	*B. pendula*	Ee
silver birch	*B. pubescens*	Es
* yellow birch	*B. alleghaniensis*	Ey
Cherry	***Prunus***	**V**
sweet cherry	*P. avium*	Vs

1 Introduced species not known to occur on Crown Land, but requiring a code for database purposes, are indicated with an asterisk.

Cypress	***Chamaecyparis***	**Y**
* Port Orford-cedar	*C. lawsoniana*	Yp
Fir (Balsam)	***Abies***	**B**
* balsam fir	*A. balsamea*	Bb
noble fir	*A. procera*	Bp
* Shasta red fir	*A. magnifica* var. *shastensis*	Bm
* white fir	*A. concolor*	Bc
Larch	***Larix***	**L**
* Dahurian larch	*L. gmelinii*	Ld
* Siberian larch	*L. siberica*	Ls
Maple	***Acer***	**M**
box elder	*A. negundo*	Me
* Norway maple	*A. platanoides*	Mn
* sycamore maple	*A. pseudoplatanus*	Ms
Oak	***Quercus***	**Q**
* English oak	*Q. robur*	Qe
* white oak	*Q. alba*	Qw
Other exotics		
* incense-cedar	*Calocedrus decurrens*	Oa
* giant sequoia	*Sequoiadendron giganteum*	Ob
* coast redwood	*Sequoia sempervirens*	Oc
European mountain-ash	*Sorbus aucuparia*	Od
Siberian elm	*Ulmus pumila*	Oe
common pear	*Pyrus communis*	Of
Oregon ash	*Fraxinus latifolia*	Og
* white ash	*Fraxinus americana*	Oh
* shagbark hickory	*Carya ovata*	Oi
tree-of-heaven	*Ailanthus altissima*	Oj
Japanese walnut	*Juglans ailanthifolia*	Ok
Pine	***Pinus***	**P**
* Monterey pine	*P. radiata*	Pm
* red pine	*P. resinosa*	Pr
* sugar pine	*P. lambertiana*	Ps
Spruce	***Picea***	**S**
* Norway spruce	*P. abies*	Sn

BRITISH COLUMBIA

DAMAGE AGENT AND CONDITION CODES

FIELD CODES		DESCRIPTION	FIELD CODES		DESCRIPTION
A		**ANIMAL DAMAGE**			
AB		BEAR	AP		PORCUPINE
AC		CATTLE	AS		SQUIRREL
AD		DEER	AV		VOLE
AE		ELK	AX		BIRDS
AH		HARE OR RABBIT	AZ		BEAVER
AM		MOOSE			
N		**ABIOTIC INJURIES**			
NB		FIRE	NN		ROAD SALT
ND		DROUGHT	NR		REDBELT
NF		FLOODING	NS		SLIDE
NG		FROST	NW		WINDTHROW
	NGC	frost crack		NWS	windthrow-soil failure
	NGH	frost-heaved		NWT	windthrow-treatment
	NGK	shoot / bud frost kill			or harvest related
NH		HAIL			
NK		FUMEKILL	NY		SNOW, ICE, SNOW PRESS
NL		LIGHTNING	NZ		SUNSCALD
D		**DISEASE**			
DB		BROOM RUST			
	DBF	fir broom rust *Melampsorella caryophyllacearum*			
	DBS	spruce broom rust *Chrysomyxa arctostaphyli*			
DD		STEM DECAYS			
	DDA	white mottled rot *Ganoderma applanatum*			
	DDB	white spongy trunk rot *Fomes fomentarius*			
	DDD	sulfur fungus *Laetiporus sulphureus*			
	DDE	rust-red stringy rot *Echinodontium tinctorium*			
	DDF	brown crumbly rot *Fomitopsis pinicola*			
	DDH	hardwood trunk rot *Phellinus ignarius*			
	DDO	brown cubical butt & pocket rot of cedar *Postia sericeomollis*			
	DDP	red ring rot *Phellinus pini*			
	DDQ	brown trunk rot (quinine fungus) *Fomitopsis officinalis*			
	DDS	Schweinitzii butt rot *Phaeolus schweinitzii*			
	DDT	aspen trunk rot *Phellinus tremulae*			

FIELD CODES		DESCRIPTION
DF		FOLIAGE DISEASES
	DFA	western pine aster rust *Coleosporium asterum*
	DFB	delphinella tip blight *Delphinella* spp.
	DFC	large-spored spruce-labrador tea rust *Chrysomyxa ledicola*
	DFD	spruce needle cast *Lirula macrospora*
	DFE	elytroderma disease *Elytroderma deformans*
	DFF	marssonina leaf blights *Marssonina* spp
	DFG	cottonwood leaf rust *Melampsora occidentalis*
	DFH	larch needle blight *Hypodermella laricis*
	DFL	pine needle cast *Lophodermella concolor*
	DFM	larch needle cast *Meria laricis*
	DFP	fir-fireweed rust *Pucciniastrum epilobii*
	DFR	Douglas-fir needle cast *Rhabdocline pseudotsugae*
	DFS	dothistroma (red band) needle blight *Mycosphaerella pini*
	PSS	sirococcus tip blight *Sirococcus strobilinus*
	PDT	cedar leaf blight *Didymascella thujina*
DL		LEADER OR BRANCH DIEBACKS
	DLD	dermea canker *Dermea pseudotsugae*
	DLF	red flag disease *Potebniamyces balsamicola*
	DLK	conifer cytospora canker *Leucostoma kunzei*
	DLP	diaporthe canker *Diaporthe lokoyae*
	DLS	sydowia tip dieback *Sclerophoma pithyophila*
	DLV	aspen & poplar leaf and shoot blights *Venturia spp.*
DM		DWARF MISTLETOES
	DMF	Douglas-fir dwarf mistletoe *Arceuthobium douglasii*
	DMH	hemlock dwarf mistletoe *Arceuthobium tsugense*
	DML	larch dwarf mistletoe *Arceuthobium laricis*
	DMP	lodgepole pine dwarf mistletoe *Arceuthobium americanum*
DR		ROOT DISEASES
	DRA	armillaria root disease *Armillaria ostoyae*
	DRB	blackstain root disease *Leptographium wageneri*
	DRC	laminated root rot (cedar form) *Phellinus weirii*
	DRL	laminated root rot (Fd form) *Phellinus weirii*
	DRN	annosus root disease *Heterobasidion annosum*
	DRR	rhizina root disease *Rhizina undulata*
	DRS	schweinitzii butt rot *Phaeolus schweinitzii*
	DRT	tomentosus root rot *Inonotus tomentosus*

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FIELD CODES	DESCRIPTION
DS	STEM DISEASE (CANKER OR RUST)
DSA	atropellis canker *Atropellis piniphila*
DSB	white pine blister rust *Cronartium ribicola*
DSC	comandra blister rust *Cronartium comandrae*
DSE	sooty bark canker *Encoelia pruinosa*
DSG	western gall rust *Endocronartium harknessii*
DSH	hypoxylon canker *Entoleuca mammatum*
DSP	cryptosphaeria canker *Cryptosphaeria populina*
DSR	ceratocystis canker *Ceratocystis fimbriata*
DSS	stalactiform blister rust *Cronartium coleosporioides*
DSY	cytospora canker *Valsa sordida*
I	**INSECTS**
IA	APHIDS *OR ADELGIDS*
IAB	balsam woolly adelgid *Adelges piceae*
IAC	giant conifer aphid *Cinara spp*
IAG	Cooley spruce gall adelgid *Adelges cooleyi*
IAL	larch cone woolly aphid *Adelges lariciatus*
IAS	spruce aphid *Elatobium abietinum*
IB	BARK BEETLES
IBB	western balsam bark beetle *Dryocoetes confusus*
IBD	Douglas-fir beetle *Dendroctonus pseudotsugae*
IBI	engraver beetles *Ips*
IBM	mountain pine beetle *Dendroctonus ponderosae*
IBP	twig beetles *Pityogenes, Pityophthorus spp*
IBS	spruce beetle *Dendroctonus rufipennis*
IBT	red turpentine beetle *Dendroctonus valens*
IBW	western pine beetle *Dendroctonus brevicomis*
ID	DEFOLIATING INSECTS
IDA	black army cutworm *Actebia fennica*
IDB	two-year budworm *Choristoneura biennis*
IDC	larch casebearer *Coleophora laricella*
IDD	western winter moth *Erannis vancouverensis*
IDE	spruce budworm *Choristoneura fumiferana*
IDF	forest tent caterpillar *Malacosoma disstria*
IDG	green-striped forest looper *Melanolophila imatata*
IDH	western blackheaded budworm *Acleris gloverana*
IDI	pine needle sheath miner *Zelleria haimbachi*
IDL	western hemlock looper *Lambdina fiscellaria lugubrosa*
IDM	gypsy moth *Lymantria dispar*
IDN	birch leaf miner *Fenusa pusilla*

FIELD CODES	DESCRIPTION
IDP	larch sawfly *Pristiphora erichsonii*
IDR	alder sawfly *Eriocampa ovata*
IDS	conifer sawflies *Neodiprion* spp.
IDT	Douglas-fir tussock moth *Orgyia pseudotsugata*
IDU	satin moth *Leucoma salicis*
IDV	variegated cutworm *Peridroma saucia*
IDW	western spruce budworm *Choristoneura occidentalis*
IDX	large aspen tortrix *Choristoneura conflictana*
IDZ	western false hemlock looper *Nepytia freemani*
IS	SHOOT INSECTS
ISB	western cedar borer *Trachykele blondeli*
ISE	European pine shoot moth *Rhyaconia buoliana*
ISG	gouty pitch midge *Cecidomyia piniinopis*
ISP	pitch nodule moths *Petrova* spp.
ISS	western pine shoot borer *Eucosma sonomana*
ISQ	Sequoia pitch moth *Synanthedon sequoiae*
IW	WEEVILS
IWC	conifer seedling weevil *Steremnius carinatus*
IWM	Magdalis sp.
IWP	lodgepole pine terminal weevil *Pissodes terminalis*
IWS	white pine weevil (on spruce) *Pissodes strobi*
IWW	Warren's root collar weevil *Hylobius warreni*
IWY	cylindrocopturus weevil *Cylindrocopturus* spp.
IWZ	Yosemite bark weevil *Pissodes schwartzii*
M	**MITE DAMAGE (TRISETACUS SPECIES)**
T	**TREATMENT INJURIES**
TC	CHEMICAL
TH	HARVESTED
TL	LOGGING
TM	OTHER MECHANICAL DAMAGE (NON-LOGGING)
TP	PLANTING
TPM	planting — poor microsite
TR	PRUNING
TT	THINNING OR SPACING
V	**VEGETATION PROBLEMS**
VH	HERBACEOUS COMPETITION
VP	VEGETATION PRESS
VS	SHRUB COMPETITION
VT	TREE COMPETITION

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