Field Manual for Describing Terrestrial Ecosystems

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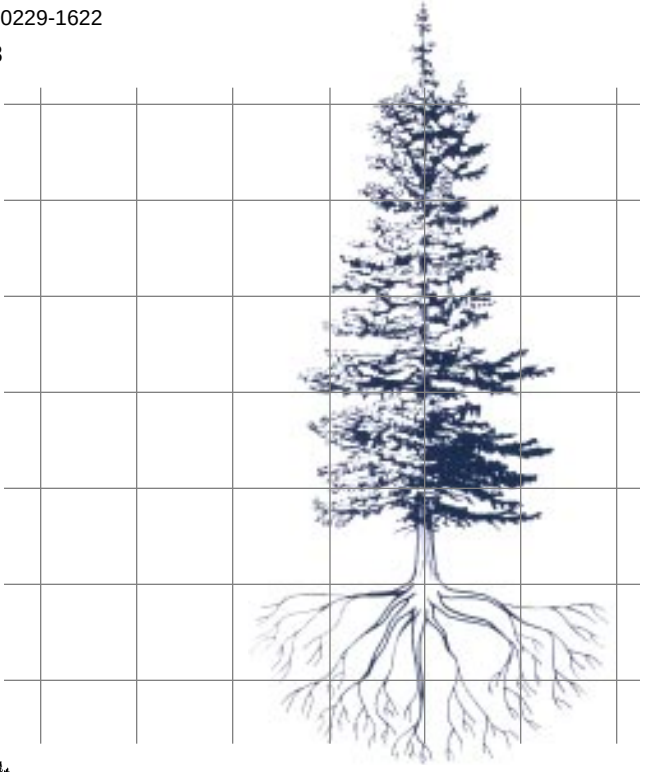

BRITISH COLUMBIA

B.C. Ministry of Environment, Lands, and Parks
B.C. Ministry of Forests

Field Manual
for
Describing Terrestrial Ecosystems

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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**
References ..... **REF**
Ground Inspection (included as an insert) ..... **GIF**

The forms are designed to be used in various inventories, e.g., 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), however, it has been updated to accommodate new inventory requirements and standards. The forms evolved from the B.C. Ministry of Forests Ecological Classification Reconnaissance Form, the larger more detailed forms in Luttmerding et al. (1990), and the Vegetation Resource Inventory forms (Resources Inventory Committee 1997).

The size of sample plots has not been identified in this field manual. 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.
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 (Section 8) for a complete list of complementary documents.

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 work was completed by Del Meidinger, Rick Trowbridge, Anne Macadam, and Calvin Tolkamp. However, many others kindly contributed their time and current information, including: John Parminter, Bob Maxwell, Scott Smith, Charles Tarnocai, and Will Mackenzie. Assistance in editing various versions was provided by Ted Lea, Barb von Sacken, Carmen Cadrin, Larry Lacelle, Tina Lee and Arman Mirza. Greg Britton contributed valuable suggestions concerning data formats and codes.

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 the field guide. Louise Gronmyr and Christina Stewart typed the original material from *Describing Ecosystems in the Field*. Anette Thingsted assisted with an earlier draft. Susan Bannerman prepared an extremely useful English and format edit. Tetrad Creative Services and Greg Britton prepared the camera-ready version.

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

Financial assistance for preparing this guide has been provided by the B.C. Ministry of Forests, B.C. Ministry of Environment, Lands, and Parks, and particularly, Forest Renewal B.C.

1 SITE DESCRIPTION

Contents

ECOSYSTEM FIELD FORM

BRITISH COLUMBIA

MINISTRY OF FORESTS
BC ENVIRONMENT

DATE	Y	M	D
(1)			

PLOT NO. (2)

PROJECT ID. (3)

FIELD NO. (4)

SURVEYOR(S) (5)

SITE DESCRIPTION

LOCATION

GENERAL LOCATION (6)

FOREST REGION (7)	MAPSHEET (8)	UTM ZONE (9)	LAT./ NORTH. (10)	LONG./ EAST.

AIRPHOTO NO. (11)	X CO-ORD. (12)	Y CO-ORD.	MAP UNIT (13)

SITE INFORMATION

PLOT REPRESENTING (15)

BGC UNIT (16)	SITE SERIES (17)	TRANS./ DISTRIB. (18)	ECOSECTION (19)

MOISTURE REGIME (20)	NUTRIENT REGIME (21)	SUCCESS. STATUS (22)	STRUCT. STAGE (23)	REALM/ CLASS (24)

ELEV. (27) m.	SLOPE (28) %	ASPECT (29) °	MESO SLOPE POS. (30)	SURFACE TOPOG. (31)

NOTES

(34)

SITE DIAGRAM

(14)

SITE DISTURB. (25)	PHOTO ROLL (26)

EXPOS. TYPE (32)	FRAME NOS.

SUBSTRATE (%)

ORG. MATTER		ROCKS	
DEC. WOOD	(33)	MINERAL SOIL	
BEDROCK		WATER	

FS882 (1) HRE 98/5

Field Procedure

Getting Started

1. Record the date, project ID, field number, surveyor(s) name(s), general location, forest region, and ecosection. Copy the plot number to other forms.
2. If air photos are available, record flight line and photo numbers at this time. If GPS co-ordinates are available, record latitude and longitude.
3. Establish the location of plot boundaries.

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. Enter a brief description of key site features under Item 15, "Plot Representing."
10. Check that all the required form information has been collected. Strike through any fields that were not assessed.

Later in the Office

1. Locate the plot on a 1:20 000 map (or other scale), and record the map sheet number. If latitude and longitude were not entered in the field, determine the UTM zone and co-ordinates from the map.

2. Compare elevation recorded in the field with that indicated on a topographic map, and adjust if appropriate.
3. Locate the plot on an air photo and determine *X* and *Y* co-ordinates.
4. Check again that all the required information has been collected and noted on the form.

Refer to the following guides for more information:

- Ministry of Forests (MOF) 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-digit codes for year, month, and day.

2. Plot Number

This is the number printed in red in the top right corner of form. It provides a unique plot identifier for data management purposes. Record this number on all other forms completed for the plot.

3. Project ID

Enter a descriptor that connotes the type of project and provides information about the subject or location of the project. For example:

- ecosystem mapping projects: TEM_BeaverCove
- species inventory: SPP_Woss
- site series classification: BEC_SBSwk1
- wildlife habitat inventory: WHI_grizzly
- site index: SIBEC_Morice

4. Field Number

Use up to eight characters to further identify the plot according to the needs of the specific project.

5. Surveyor(s)

Record the first initial and last name of each person involved in describing the site.

6. General Location

Describe the location of the plot relative to natural features such as mountains or bodies of water and permanent structures such as kilometre signs on main roads.

- 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 34, "Notes."

7. Forest Region

This information can be useful for sorting plot data. Use the following codes:

CAR = Cariboo
KAM = Kamloops
NEL = Nelson
PG = Prince George
PR = Prince Rupert
VAN = Vancouver

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 plot using the best available topographic base map. Latitude and longitude may also be determined using GPS. While either system may be used, the UTM system is recommended if coordinates are determined from a map.

- For latitude and longitude, note degrees (°), minutes (‘), and seconds (“).
- For UTM system, record northing and easting (NAD83).

11. Air Photo Number

Record the flight line and air photo number.

12. *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).

13. Map Unit

If the plot is part of a mapping project, enter coding for the terrestrial ecosystem (TEM) or other map unit (eg., soils, terrain, etc.). TEM unit coding is as follows:

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

14. 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).

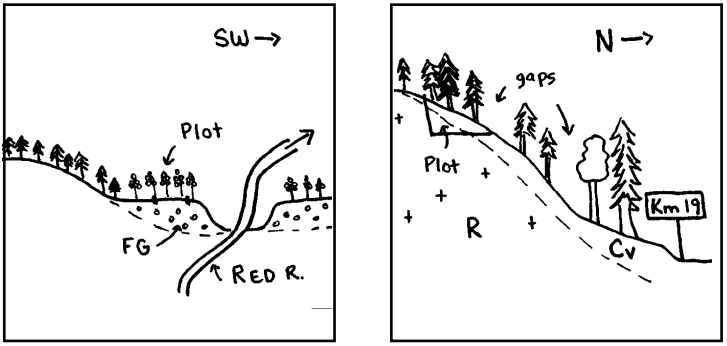


FIGURE 1.1 Examples of site diagrams.

15. Plot Representing

Briefly characterize the site. If the plot was not selected randomly or systematically, describe the key attributes for which it was chosen. For example:

- Open Pl stand; kinnikinnick, lichens on FG terrace
- Young highly productive Fd stand on zonal site
- Sxw– horsetail–ladyfern, Hydromor, Humic Gleysol, on floodplain

16. Biogeoclimatic Unit

Enter a code for the biogeoclimatic zone and subzone. Include variant and phase where applicable. Ministry of Forests maps and regional field guides to site identification and interpretation are the best sources of information. A current listing of codes is given in Appendix 1.1.

- 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 34).

17. Site Series

Enter a two-digit site series code and a letter code for site series phases, where recognized, from the appropriate MOF 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. 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).
- If the ecosystem does not resemble a recognized site series, leave this field blank, and explain under "Notes".

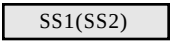
18. Transition / Distribution Codes

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.

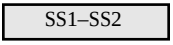
Mostly homogeneous plots (codes 1–3):

SS1

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.



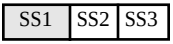
3 A homogeneous plot, but classification is intermediate between SS1 and SS2.

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

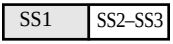
4 Gradual transition from SS1 at one edge of plot to SS2 at other edge, or from SS2 to SS3, with SS1 being the modal site series. In the latter case, SS1 usually represents > 50% of plot.

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.

19. Ecosection

Enter a three-letter code for the ecosection. See Appendix 1.2 for a current listing of codes.

20. 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 biogeoclimatic unit. Classes are listed with brief descriptions in Table 1.1. 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)).
- If a wide range of moisture regimes is present, list the dominant and sub-dominant class, followed by the range (e.g. 4 (5), 4–6).
- 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
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

Code	Class	Description	Primary water source
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

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

21. 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.

- 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*).

22. Successional Status

Enter the two or three-character uppercase code for successional status. Apply these codes where forest succession is expected to occur. Under extreme conditions, stand age may vary from the age ranges suggested here.

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

	Oligotrophic	Submesotrophic	Mesotrophic	Permesotrophic	Eutrophic	Hypereutrophic
	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	Mor	Mor / Moder	Moder	Moder / Mull	Mull
A horizon	Ae horizon present	Ae horizon present	A horizon absent	A horizon absent / Ah horizon present	Ah horizon present	Ah horizon present
Organic matter content	low (light coloured)	low (light coloured) / medium (inter. in colour)	medium (inter. in colour)	medium (inter. in colour) / high (dark coloured)	high (dark coloured)	high (dark coloured)
C:N Ratio	high	high	high / moderate	moderate	moderate / low	low
Soil depth	extremely shallow	extremely shallow / very shallow to deep	very shallow to deep	very shallow to deep	very shallow to deep	very shallow to deep
Soil texture	coarse textured	coarse textured	coarse textured / medium to fine textured	medium to fine textured	medium to fine textured	medium to fine textured
% Coarse fragments	high	high	high / moderate to low	moderate to low	moderate to low	moderate to low
Parent material mineralogy	base-low	base-low	base-low / base-medium	base-medium	base-medium / base-high	base-high
Soil pH	extremely – mod. acid	extremely – mod. acid / moderately acid – neutral	moderately acid – neutral	moderately acid – neutral / slightly acid – mildly alk.	slightly acid – mildly alk.	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	temporary →	permanent	

NV = Non-Vegetated:
Vegetation is either *absent* or *less than five percent cover* because of recent severe disturbances such as fire, mass-wasting, or flooding.

PS = Pioneer Seral:
Stage where vegetation occupies a site following the elimination of the original plant cover by a disturbance such as fire, logging, or scalping of the soil surface.

- May also be an early stage of development on talus slopes or erosion scars.

YS = Young Seral:
Young stands of early seral species or communities where self-thinning has not yet occurred.

- Generally young even-aged stands (usually < 60 years old) with an even canopy height.
- Includes dense stagnated pine stands, which may be up to 100 years old.

Young seral stand

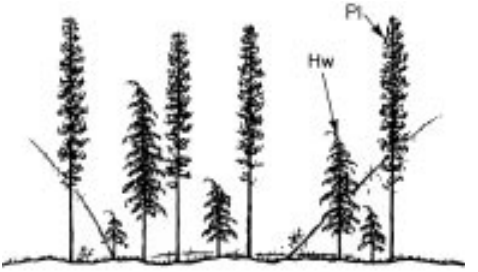
MS = Maturing Seral:
Mid-seral stands of mature age (generally 60–140 years old) that have gone through an initial natural thinning due to species interactions.

- One age class in the overstorey and regeneration in a much younger age class, composed of same species, and/or climax species, and/or species with greater shade tolerance.

Maturing seral stand

OS = Overmature Seral:
Stands dominated by the original overstorey species at a "decadent" age (usually > 140 years old).

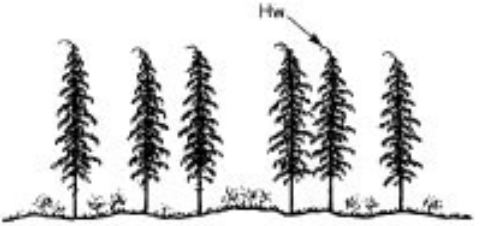
- Tree species in the main upper canopy are dying.
- Typically a secondary tree canopy consisting of same species or a more shade-tolerant species; some individuals belonging to second generation may have entered the main canopy.



Overmature seral stand

YC = Young Climax:
Stand is composed of species in proportions typical of the climax expected for the site, but the community structure expected at climax has not developed.

- Differs from climax stage in being even-aged and young (< 80 years old), and having a uniform canopy height.



Young climax stand

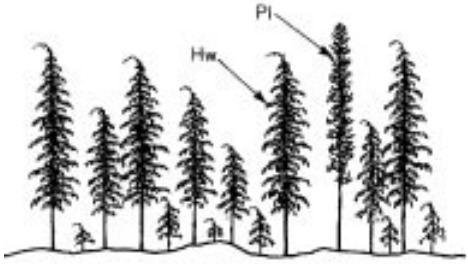
YCC = Young Climatic Climax:
Young stands (< 80 years old) on zonal sites, composed of the same species expected in climatic climax stands; differ from MCC stands in having a stand structure that is more or less even-aged and of uniform height class.

YEC = Young Edaphic Climax:
Young stands (usually < 80 years old) composed of the same species expected at climax on a site edaphically different from a "zonal" site.

- Differs in stand structure from the MEC in being more or less even-aged and of uniform height class.
- Examples include a young spruce stand on a wet site, or a young Douglas-fir stand on a dry, south-facing slope.

MC = Maturing Climax:
Stands composed of species expected to be present in the climax stand; stand has undergone natural thinning, gaps have been created, and a structure similar to that expected at climax has developed.

- Differs from the YC in having a better-developed understorey and a more or less continuous age and height class distribution, although a gap may exist between the older or upper class and the next class.
- Some remnants of the earlier stand may remain, but they should not have any effect on the density or structure of the stand. Removal of a tree would not cause a significant response in the growth or establishment of the climax trees.



Maturing climax stand

MCC = Maturing Climatic Climax:
Stands on zonal sites composed of the species representative of the climatic climax, and approaching a continuous age and height class distribution.

- There may be a gap between the main canopy and the continuous age and height class distribution of the regeneration.
- Stands are at least 80–120 years old, but usually much older.

MEC = Maturing Edaphic Climax:
Differs from MCC stands in species composition and site conditions (occurs on azonal sites); soil properties differ primarily in terms of soil moisture and nutrient regime.

- Species differences may be in stand or understorey.
- Examples include grassland communities on coarse-textured or shallow soils; spruce–horsetail communities on floodplains; bogs and fens in large depressional areas; cedar–devil's club communities on moist, rich sites in a BGC unit where cedar–hemlock–oakfern communities occur on zonal sites.

DC = Disclimax:
A self-perpetuating community that strongly differs in species composition from the edaphic or climatic climax expected for the site; normal succession has been arrested by an external physical or anthropogenic factor.

- Results from changes to the physical characteristics of the site, associated with disturbances such as fire, intensive grazing, or avalanche.

NOTE: The codes **EC** or **CC**, for Edaphic Climax or Climatic Climax, may be used where it is difficult to determine whether the successional status is "young" or "maturing."

23. Structural Stage[1]

In the assessment of structural stage, structural features and age criteria should be considered. Use numeric and lowercase alphabetic codes unless otherwise directed. Modifiers for structural stage (Figure 1.2) and stand composition are optional. Separate modifier codes from the structural stage code with a slash (e.g., 7/mC; 3b/D). Uppercase codes in parentheses are used in Vegetation Resources Inventory (Resource Inventory Committee, 1997).

Post-disturbance stages, or environmentally limited structural development:

1 (SB) **Sparse/bryoid** Initial stages of primary and secondary succession; bryophytes and lichens often dominant; time since disturbance < 20 years for normal forest succession, may be prolonged (50–100+ years) where there is little or no soil development (bedrock, boulder fields); total shrub and herb cover < 20%; total tree cover < 10%.

[1] Structural stage categories and modifiers presented here draw on schemes proposed by Hamilton (1988), Oliver and Larson (1990), Weetman et al. (1990), and Vegetation Inventory Working Group (1995).

1a (SP) **Sparse** – less than 10% vegetation cover; or

1b (BR) **Bryoid** – bryophyte and lichen-dominated communities (> 50% of total vegetation cover).

Stand initiation stages or environmentally induced structural development:

2 (H) **Herb** Early successional stage or herb communities maintained by environmental conditions or disturbance (e.g., snow fields, avalanche tracks, wetlands, flooding, grasslands, intensive grazing, intense fire damage); dominated by herbs (forbs, graminoids, ferns); some invading or residual shrubs and trees may be present; tree cover < 10%, shrubs ≤ 20% or < 33% of total cover, herb-layer cover > 20%, or ≥ 33% of total cover; time since disturbance < 20 years for normal forest succession; many non-forested communities are perpetually maintained in this stage.

2a (FO) **Forb-dominated** – includes non-graminoid herbs and ferns;

2b (GR) **Graminoid-dominated** – includes grasses, sedges, reeds, and rushes;

2c (AQ) **Aquatic** – floating or submerged; does not include sedges growing in marshes with standing water (classed as 2b); or

2d (DS) **Dwarf shrub-dominated** – dominated by dwarf woody species such as *Arctostaphylos alpina, Salix reticulata, Rhododendron lapponicum, Cassiope tetragona* (see Table 3.1 in Vegetation section).

3 (SH) **Shrub/Herb** Early successional stage or shrub communities maintained by environmental conditions or disturbance; dominated by shrubby vegetation; seedlings and advance regeneration may be abundant; tree cover < 10%, shrub cover > 20% or ≥ 33% of total cover.

3a (LS) **Low shrub** – dominated by shrubby vegetation < 2 m tall; seedlings and advance regeneration may be abundant; time since disturbance < 20 years for normal forest succession; may be perpetuated indefinitely by environmental conditions or disturbance; or

3b (TS) **Tall shrub** – dominated by shrubby vegetation that is 2–10 m tall; seedlings and advance regeneration may be abundant; time since disturbance < 40 years for normal forest succession; may be perpetuated indefinitely.

Stem exclusion stage:

4 (PS) **Pole/Sapling** Trees > 10 m tall, typically densely stocked, have overtopped shrub and herb layers; younger stands are vigorous (usually > 10–15 years old); older stagnated stands (up to 100 years old) are also included; self-thinning and vertical structure not yet evident in the canopy – this often occurs by age 30 in vigorous broadleaf stands, which are generally younger than coniferous stands at the same structural stage; time since disturbance < 40 years for normal forest succession; up to 100+ years for dense (5000 – 15000+ stems per ha) stagnant stands.

5 (YF) **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 PS stage; begins as early as age 30 and extends to 50–80 years; time since disturbance generally 40–80 years, depending on tree species and ecological conditions.

Understorey reinitiation stages:

6 (MF) **Mature Forest** Trees established after the last disturbance have matured; a second cycle of shade-tolerant trees may have become established; understories become well developed as the canopy opens up; time since disturbance generally 80–140 years for BGC group A[2] and 80–250 years for group B[3].

Old-growth stage:

7 (OF) **Old Forest** Old, structurally complex stands comprised mainly of shade-tolerant and regenerating tree species, although older seral and long-lived trees from a disturbance such as fire may still dominate the upper canopy; snags and coarse woody debris in all stages of decomposition and patchy understories typical; understories may include tree species uncommon in the canopy, because of inherent limitations of these species under the given conditions; time since disturbance generally > 140 years for BGC group A[2] and > 250 years for group B[3].

[2] **BGC Group A** includes BWBSdk, BWBSmw, BWBSwk, BWBSvk, ESSFdc, ESSFdk, ESSFdv, ESSFxc, ICHdk, ICHdw, ICHmk1, ICHmk2, ICHmw1, ICHmw3, MS, SBPS, SBSdh, SBSdk, SBSdw, SBSmc, SBSmh, SBSmk, SBSmm, SBSmw, SBSwk1 (on plateau), and SBSwk3.

[3] **BGC Group B** includes all other biogeoclimatic units.

Stand composition modifiers (stages 3–7 only)

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)

Structural stage modifiers (stages 4–7 only) (see Figure 1.2):

s = single-storied Closed 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[4]; advance regeneration in the understorey is generally sparse.

t = two-storied Closed 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[4]; advance regeneration variable.

m = multistoried Closed forest stand with all crown classes well represented; each of the intermediate and suppressed classes comprise greater than 20% of all crown classes combined[4]; advance regeneration variable.

i = irregular Forest stand with very open overstorey and intermediate crown classes (totalling less than 30% cover), with well developed suppressed crown class; advance regeneration variable.

h = shelterwood Forest stand with very open overstorey (less than 20% cover) with well developed suppressed crown class and/or advance regeneration in the understorey. Intermediate crown class generally absent.

24. Realm/Class

Currently applied to wetland and riparian ecosystems only. Enter the following codes for realm or group, where applicable, and class.

Terrestrial realm, transition group:

Tc **Shrub carr** Low-shrub-dominated ecosystem in frost-prone basins; never inundated and seasonally saturated; usually extremely mounded, shrubs on elevated sites; herb and moss layers diverse, often dominated by forbs and grasses.

[4] Based on either basal area or percent cover estimates.

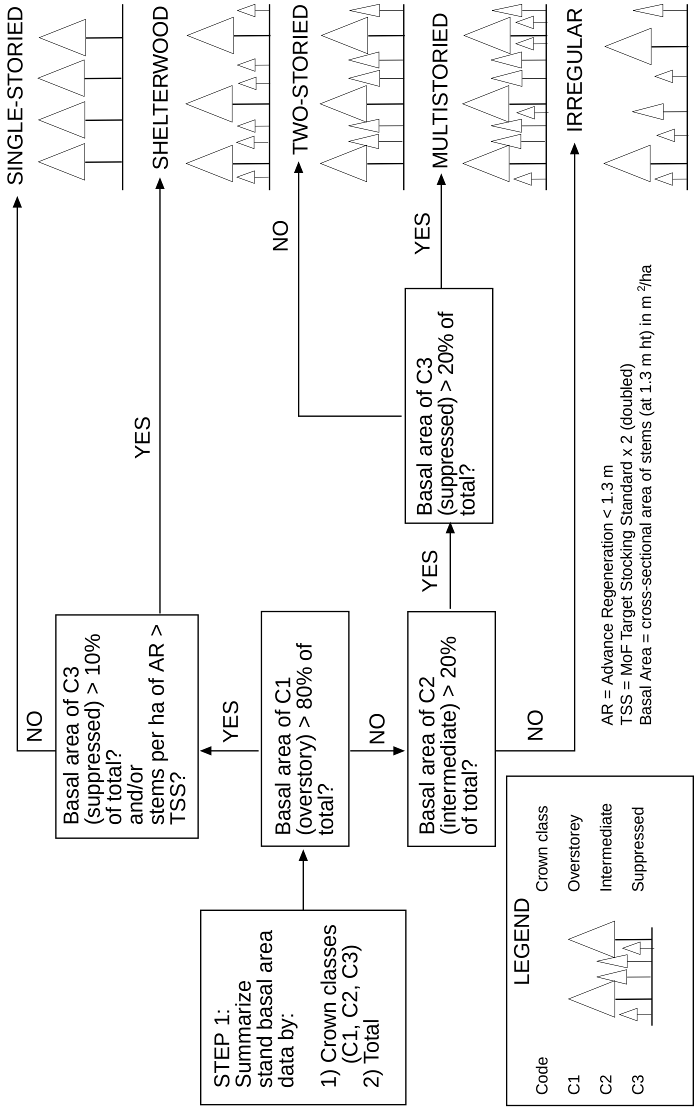


FIGURE 1.2. Stand structure modifiers.

Th **High meadow** Mainly in subalpine and alpine regions; lush forb-rich flora; persistent snowpack and prolonged growing season seepage.

Tm **Wet meadow** Develop on mineral materials; periodically saturated, seldom inundated; diverse community of grasses, low sedges, rushes (*Juncus* spp.), and forbs.

Ts **Saline meadow** Occur in dry interior areas of province around saline lakes and in shallow depressions that dry out early in the growing season; high soil salinities; water table often remains high; salt-tolerant plants.

Terrestrial realm, flood group:

Fl **Low bench** Flooded at least every other year for moderate periods of growing season; plant species adapted to extended flooding and abrasion; low or tall shrub physiognomy most common.

Fm **Middle bench** Flooded every 1–6 years for short periods (10–25 days); deciduous or mixed forest dominated by species tolerant of flooding and periodic sedimentation; trees occur on elevated microsites.

Fh **High bench** Only periodically and briefly inundated by high waters, but lengthy subsurface flow in the rooting zone; typically conifer-dominated floodplains of larger coastal rivers.

Ff **Fringe** Narrow linear communities along open water bodies where there is no floodplain; irregular flooding at depth, moderated microclimate, improved light regime (in forested areas), and/or mechanical disturbance by ice.

Wetland realm:

Wb **Bog** Nutrient-poor peatlands (pH < 4.5) characterized by plant communities with a large component of ericaceous shrubs and *Sphagnum* mosses.

Wf **Fen** Nutrient-medium peatlands fed by ground or surface water sources; dominated by sedges, grasses, reeds, and brown mosses; non-ericaceous shrubs common.

Wm **Marsh** Mineral wetland that retains shallow surface water for much of growing season; dominated by emergent sedges, grasses, rushes, or reeds.

Ws **Swamp** Treed or shrubby mineral wetland; water table at or near surface for most of year; if peat present, mainly dark and well decomposed; high cover of broadleaf or coniferous trees or tall shrubs, forbs and leafy mosses.

Ww Shallow water Distinct wetlands transitional between wetlands and aquatic ecosystems; characterized by rooted aquatics and standing water < 2 m deep in mid-summer.

Estuarine Realm:

Em Salt marsh Tidally influenced wetland dominated by graminoid emergents; alternately flooded and exposed with daily tides; both marine and fresh water sources.

Ed Salt meadow Tidally influenced herbaceous wetlands in upper intertidal and supratidal zones of estuaries; tidal flooding less frequent than daily.

Es Salt swamp Treed or shrubby mineral wetlands in brackish lagoons; occasional tidal flooding and subsequent evaporation; waterlogged, highly saline soil.

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./E.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)[5]
e. excrement accumulation (other than that normally associated with grazing/browsing) (5.1)[5]

i. insects (4.2)[5]
  ki insect kill
  in infestation
p. disease (4.2)[5]
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
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

[5] Record type or species under "Notes" using codes given in Appendix 4.2 of the Mensuration section or Appendix 5.1 of the Wildlife Habitat Assessment section of this manual.

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")

26. Photo Roll and Frame Numbers

If photographs are taken, note the roll and frame numbers.

27. Elevation

Determine in the field using an altimeter. Accuracy of the measurement can be confirmed by consulting a topographic map. Record in *metres* with an estimate of accuracy.

28. Slope

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

29. Aspect

Record the orientation of the slope, measured by compass, in *degrees*.

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

30. 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.

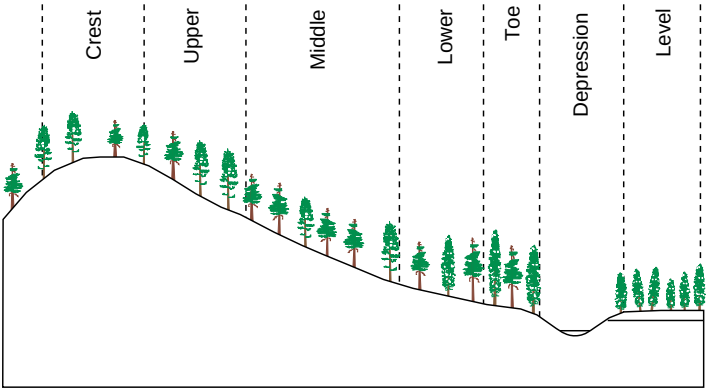


FIGURE 1.3. Mesoslope position.

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.

31. Surface Topography

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

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

32. 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".

33. 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 ≥ 1 cm thick overlying mineral soil, 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 mineral material.

- May have a partial covering of mosses, lichens, liverworts, or other epilithic plants.
- Does not qualify as bedrock if covered by unconsolidated mineral or organic material ≥ 1 cm in thickness.

Rock (cobbles and stones) Exposed unconsolidated rock fragments > 7.5 cm in diameter.

- May be covered by mosses, lichens, liverworts; or an organic layer < 1 cm in thickness.
- Does not include gravels < 7.5 cm in diameter.

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

- May have a partial cover of mosses, lichens, and liverworts.
- Often associated with cultivation, tree tip-ups, active erosion or deposition, severe fires, trails, or late snow retention areas.
- Includes small cobbles and gravel < 7.5 cm in diameter.

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

34. 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 Biogeoclimatic Units of British Columbia

Zone	Subzone	Variant	Name
AT			**Alpine Tundra Zone**
			(no subzones recognized currently)
BG			**Bunchgrass Zone**
	BGxh		Very Dry Hot BG
		BGxh1	Okanagan BGxh
		BGxh2	Thompson BGxh
		BGxh3	Fraser BGxh
	BGxw		Very Dry Warm BG
		BGxw1	Nicola BGxw
		BGxw2	Alkali BGxw
BWBS			**Boreal White and Black Spruce Zone**
	BWBSdk		Dry Cool BWBS
		BWBSdk1	Stikine BWBSdk
		BWBSdk2	Liard BWBSdk
	BWBSmw		Moist Warm BWBS
		BWBSmw1	Peace BWBSmw
		BWBSmw2	Fort Nelson BWBSmw
	BWBSwk		Wet Cool BWBS
		BWBSwk1	Murray BWBSwk
		BWBSwk2	Graham BWBSwk
		BWBSwk3	Kledo BWBSwk
	BWBSvk		Very Wet Cool BWBS
CDF			**Coastal Douglas-fir Zone**
	CDFmm		Moist Maritime CDF
CWH			**Coastal Western Hemlock Zone**
	CWHxm		Very Dry Maritime CWH
		CWHxm1	Eastern CWHxm
		CWHxm2	Western CWHxm
	CWHdm		Dry Maritime CWH
	CWHds		Dry Submaritime CWH

Zone	Subzone	Variant	Name
		CWHds1	Southern CWHds
		CWHds2	Central CWHds
	CWHmm		Moist Maritime CWH
		CWHmm1	Submontane CWHmm
		CWHmm2	Montane CWHmm
	CWHms		Moist Submaritime CWH
		CWHms1	Southern CWHms
		CWHms2	Central CWHms
	CWHwh		Wet Hypermaritime CWH
		CWHwh1	Submontane CWHwh
		CWHwh2	Montane CWHwh
	CWHwm		Wet Maritime CWH
	CWHws		Wet Submaritime CWH
		CWHws1	Submontane CWHws
		CWHws2	Montane CWHws
	CWHvh		Very Wet Hypermaritime CWH
		CWHvh1	Southern CWHvh
		CWHvh2	Central CWHvh
	CWHvm		Very Wet Maritime CWH
		CWHvm1	Submontane CWHvm
		CWHvm2	Montane CWHvm
		CWHvm3	Central CWHvm
ESSF			**Engelmann Spruce – Subalpine Fir Zone**
	ESSFxc		Very Dry Cold ESSF
	ESSFxv		Very Dry Very Cold ESSF
		ESSFxv1	West Chilcotin ESSFxv
		ESSFxv2	Big Creek ESSFxv
	ESSFdk		Dry Cool ESSF
	ESSFdku		Upper Dry Cool ESSF
	ESSFdc		Dry Cold ESSF
		ESSFdc1	Okanagan ESSFdc
		ESSFdc2	Thompson ESSFdc
	ESSFdv		Dry Very Cold ESSF
	ESSFmw		Moist Warm ESSF
		ESSF mwh	Hemlock Phase, ESSFmw
	ESSFmm		Moist Mild ESSF
		ESSFmm1	Raush ESSFmm
		ESSFmm2	Robson ESSFmm
	ESSFmk		Moist Cool ESSF
	ESSFmc		Moist Cold ESSF
	ESSFmv		Moist Very Cold ESSF
		ESSFmv1	Nechako ESSFmv

Zone	Subzone	Variant	Name
		ESSFmv2	Bullmoose ESSFmv
		ESSFmv3	Omineca ESSFmv
		ESSFmv4	Graham ESSFmv
	ESSFwm		Wet Mild ESSF
	ESSFwk		Wet Cool ESSF
		ESSFwk1	Cariboo ESSFwk
		ESSFwk2	Misinchinka ESSFwk
	ESSFwc		Wet Cold ESSF
		ESSFwc1	Columbia ESSFwc
		ESSFwc2	Northern Monashee ESSFwc
		ESSFwc3	Cariboo ESSFwc
		ESSFwc4	Selkirk ESSFwc
	ESSFwv		Wet Very Cold ESSF
	ESSFvc		Very Wet Cold ESSF
	ESSFvv		Very Wet Very Cold ESSF
	ESSFxcp		Very Dry Cold Parkland ESSF
	ESSFxvp		Very Dry Very Cold Parkland ESSF
		ESSFxvp1	West Chilcotin ESSFxvp
		ESSFxvp2	Big Creek ESSFxvp
	ESSFdkp		Dry Cool Parkland ESSF
	ESSFdcp		Dry Cold Parkland ESSF
		ESSFdcp1	Okanagan ESSFdcp
		ESSFdcp2	Thompson ESSFdcp
	ESSFdvp		Dry Very Cold Parkland ESSF
	ESSFmwp		Moist Warm Parkland ESSF
	ESSFmwph		Hemlock Phase, ESSFmwp
	ESSFmmp		Moist Mild Parkland ESSF
		ESSFmmp1	Raush ESSFmmp
		ESSFmmp2	Robson ESSFmmp
	ESSFmkp		Moist Cool Parkland ESSF
	ESSFmcp		Moist Cold Parkland ESSF
	ESSFmvp		Moist Very Cold Parkland ESSF
		ESSFmvp1	Nechako ESSFmvp
		ESSFmvp2	Bullmoose ESSFmvp
		ESSFmvp3	Omineca ESSFmvp
		ESSFmvp4	Graham ESSFmvp
	ESSFwmp		Wet Mild Parkland ESSF
	ESSFwcp		Wet Cold Parkland ESSF
		ESSFwcp2	Northern Monashee ESSFwcp
		ESSFwcp3	Cariboo ESSFwcp
		ESSFwcp4	Selkirk ESSFwcp
	ESSFwvp		Wet Very Cold Parkland ESSF
	ESSFvcp		Very Wet Cold Parkland ESSF
	ESSFvvp		Very Wet Very Cold Parkland ESSF

Zone	Subzone	Variant	Name
ICH			**Interior Cedar – Hemlock Zone**
	ICHxw		Very Dry Warm ICH
	ICHdw		Dry Warm ICH
	ICHdk		Dry Cool ICH
	ICHmw		Moist Warm ICH
		ICHmw1	Golden ICHmw
		ICHmw2	Columbia-Shuswap ICHmw
		ICHmw3	Thompson ICHmw
	ICHmm		Moist Mild ICH
	ICHmk		Moist Cool ICH
		ICHmk1	Kootenay ICHmk
		ICHmk2	Thompson ICHmk
		ICHmk3	Horsefly ICHmk
	ICHmc		Moist Cold ICH
		ICHmc1	Nass ICHmc
		ICHmc1a	Amabilis Fir Phase, ICHmc1
		ICHmc2	Hazelton ICHmc
	ICHwk		Wet Cool ICH
		ICHwk1	Wells Gray ICHwk
		ICHwk1c	Cold Air Phase, ICHwk1
		ICHwk2	Quesnel ICHwk
		ICHwk3	Goat ICHwk
		ICHwk4	Cariboo ICHwk
	ICHwc		Wet Cold ICH
	ICHvk		Very Wet Cool ICH
		ICHvk1	Mica ICHvk
		ICHvk1c	Cold Air Phase, ICHvk1
		ICHvk2	Slim ICHvk
	ICHvc		Very Wet Cold ICH
IDF			**Interior Douglas-fir Zone**
	IDFxh		Very Dry Hot IDF
		IDFxh1	Okanagan IDFxh
		IDFxh1a	Grassland Phase, IDFxh1
		IDFxh1b	Steep South Phase, IDFxh1
		IDFxh2	Thompson IDFxh
		IDFxh2a	Grassland Phase, IDFxh2
		IDFxh2b	Steep South Phase, IDFxh2
	IDFxw		Very Dry Warm IDF
	IDFxm		Very Dry Mild IDF
	IDFdw		Dry Warm IDF

Zone	Subzone	Variant	Name
	IDFdm		Dry Mild IDF
		IDFdm1	Kettle IDFdm
		IDFdm2	Kootenay IDFdm
	IDFdk		Dry Cool IDF
		IDFdk1	Thompson IDFdk
		IDFdk1a	Grassland Phase, IDFdk1
		IDFdk1b	Steep South Phase, IDFdk1
		IDFdk2	Cascade IDFdk
		IDFdk2b	Steep South Phase, IDFdk2
		IDFdk3	Fraser IDFdk
		IDFdk4	Chilcotin IDFdk
	IDFmw		Moist Warm IDF
		IDFmw1	Okanagan IDFmw
		IDFmw2	Thompson IDFmw
		IDFmw2a	Grassland Phase, IDFmw2
	IDFww		Wet Warm IDF
MH			**Mountain Hemlock Zone**
	MHmm		Moist Maritime MH
		MHmm1	Windward MHmm
		MHmm2	Leeward MHmm
		MHmm2e	Engelmann Spruce Phase, MHmm2
	MHwh		Wet Hypermaritime MH
		MHwh1	Windward MHwh
		MHwh2	Leeward MHwh
	MHmmp		Moist Maritime Parkland MH
		MHmmp1	Windward MHmmp
		MHmmp2	Leeward MHmmp
		MHmmp2e	Engelmann Spruce Phase, MHmmp2
	MHwhp		Wet Hypermaritime Parkland MH
		MHwhp1	Windward MHwhp
		MHwhp2	Leeward MHwhp
MS			**Montane Spruce Zone**
	MSxk		Very Dry Cool MS
	MSxv		Very Dry Very Cold MS
	MSdm		Dry Mild MS
		MSdm1	Okanagan MSdm
		MSdm2	Thompson MSdm
	MSdk		Dry Cool MS
	MSdc		Dry Cold MS

Zone	Subzone	Variant	Name
		MSdc1	Bridge MSdc
		MSdc2	Tatlayoko MSdc
	MSdv		Dry Very Cold MS
PP			**Ponderosa Pine Zone**
	PPxh		Very Dry Hot PP
		PPxh1	Okanagan PPxh
		PPxh1a	Grassland Phase, PPxh1
		PPxh2	Thompson PPxh
		PPxh2a	Grassland Phase, PPxh2
	PPdh		Dry Hot PP
		PPdh1	Kettle PPdh
		PPdh2	Kootenay PPdh
SBPS			**Sub-Boreal Pine – Spruce Zone**
	SBPSxc		Very Dry Cold SBPS
	SBPSdc		Dry Cold SBPS
	SBPBmk		Moist Cool SBPS
	SBPSmc		Moist Cold SBPS
SBS			**Sub-Boreal Spruce Zone**
	SBSdh		Dry Hot SBS
		SBSdh1	McLennan SBSdh
		SBSdh2	Robson SBSdh
	SBSdw		Dry Warm SBS
		SBSdw1	Horsefly SBSdw
		SBSdw2	Blackwater SBSdw
		SBSdw3	Stuart SBSdw
	SBSdk		Dry Cool SBS
	SBSmh		Moist Hot SBS
	SBSmw		Moist Warm SBS
	SBSmm		Moist Mild SBS
	SBSmk		Moist Cool SBS
		SBSmk1	Mossvale SBSmk
		SBSmk2	Williston SBSmk
	SBSmc		Moist Cold SBS
		SBSmc1	Moffat SBSmc
		SBSmc2	Babine SBSmc
		SBSmc3	Kluskus SBSmc

Zone	Subzone	Variant	Name
	SBSwk		Wet Cool SBS
		SBSwk1	Willow SBSwk
		SBSwk2	Finlay-Peace SBSwk
		SBSwk3	Takla SBSwk
		SBSwk3a	Douglas-fir Phase, SBSwk3
	SBSvk		Very Wet Cool SBS
SWB			**Spruce – Willow – Birch Zone**
	SWBdk		Dry Cool SWB
	SWBdks		Dry Cool Scrub SWB
	SWBmk		Moist Cool SWB
	SWBmks		Moist Cool Scrub SWB
	SWBvk		Very Wet Cool SWB
	SWBvks		Very Wet Cool Scrub SWB

APPENDIX 1.2. Ecosections of British Columbia

Ecoregion	Ecosection	Code
COAST AND MOUNTAINS		
CASCADE RANGES	Northwestern Cascade Ranges	**NWC**
CASCADIA CONTINENTAL SHELF	Vancouver Island Shelf	**VIS**
COASTAL GAP	Hecate Lowland	**HEL**
	Kitimat Ranges	**KIR**
HECATE CONTINENTAL SHELF	Dixon Entrance	**DIE**
	Hecate Strait	**HES**
	Queen Charlotte Sound	**QCS**
	Queen Charlotte Strait	**QCT**
NASS BASIN		**NAB**
NASS RANGES		**NAR**
NORTHERN COASTAL MOUNTAINS	Alaska Panhandle Mountains	**APM**
	Alsek Ranges	**ALR**
	Boundary Ranges	**BOR**
PACIFIC RANGES	Eastern Pacific Ranges	**EPR**
	Northern Pacific Ranges	**NPR**
	Outer Fiordland	**OUF**
	Southern Pacific Ranges	**SPR**
QUEEN CHARLOTTE LOWLAND		**QCL**
QUEEN CHARLOTTE RANGES	Skidegate Plateau	**SKP**
	Windward Queen Charlotte Mtns.	**WQC**
WESTERN VANCOUVER ISLAND	Nahwitti Lowland	**NWL**
	Northern Island Mountains	**NIM**
	Windward Island Mountains	**WIM**
GEORGIA DEPRESSION		
EASTERN VANCOUVER ISLAND	Leeward Island Mountains	**LIM**
	Nanaimo Lowland	**NAL**
LOWER MAINLAND	Fraser Lowland	**FRL**
	Georgia Lowland	**GEL**
GEORGIA-PUGET BASIN	Juan de Fuca Strait	**JDF**
	Southern Gulf Islands	**SGI**
	Strait of Georgia	**SOG**
CENTRAL INTERIOR		
BULKLEY RANGES		**BUR**
CHILCOTIN RANGES	Central Chilcotin Ranges	**CCR**
	Western Chilcotin Ranges	**WCR**
FRASER PLATEAU	Bulkley Basin	**BUB**
	Cariboo Basin	**CAB**
	Cariboo Plateau	**CAP**
	Chilcotin Plateau	**CHP**

Ecoregion	Ecosection	Code
	Fraser River Basin	**FRB**
	Nazko Upland	**NAU**
	Nechako Upland	**NEU**
	Quesnel Lowland	**QUL**
	Western Chilcotin Upland	**WCU**
SUB-BOREAL INTERIOR		
CENTRAL CANADIAN ROCKY MOUNTAINS	Hart Foothills	**HAF**
	Hart Ranges	**HAR**
	Misinchinka Ranges	**MIR**
	Peace Foothills	**PEF**
FRASER BASIN	Babine Upland	**BAU**
	McGregor Plateau	**MCP**
	Nechako Lowland	**NEL**
OMINECA MOUNTAINS	Eastern Skeena Mountains	**ESM**
	Manson Plateau	**MAP**
	Parsnip Trench	**PAT**
	Southern Omineca Mountains	**SOM**
SKEENA MOUNTAINS	Northern Skeena Mountains	**NSM**
	Southern Skeena Mountains	**SSM**
SOUTHERN INTERIOR MOUNTAINS		
COLUMBIA HIGHLANDS	Bowron Valley	**BOV**
	Quesnel Highland	**QUH**
	Shuswap Highland	**SHH**
NORTHERN COLUMBIA MOUNTAINS	Cariboo Mountains	**CAM**
	Central Columbia Mountains	**CCM**
	Eastern Purcell Mountains	**EPM**
	McGillivray Range	**MCR**
	Northern Kootenay Mountains	**NKM**
	Southern Columbia Mountains	**SCM**
EASTERN CONTINENTAL RANGES	Front Ranges	**FRR**
NORTHERN CONTINENTAL DIVIDE	Border Ranges	**BRR**
	Crown of the Continent	**COC**
SELKIRK-BITTERROOT FOOTHILLS	Selkirk Foothills	**SFH**
SOUTHERN ROCKY MOUNTAIN TRENCH	Big Bend Trench	**BBT**
	East Kootenay Trench	**EKT**
	Upper Fraser Trench	**UFT**
WESTERN CONTINENTAL RANGES	Central Park Ranges	**CPK**
	Northern Park Ranges	**NPK**
	Southern Park Ranges	**SPK**
SOUTHERN INTERIOR		
INTERIOR TRANSITION RANGES	Leeward Pacific Ranges	**LPR**
	Pavilion Ranges	**PAR**
	Southern Chilcotin Ranges	**SCR**

Ecoregion	Ecosection	Code
OKANOGAN HIGHLAND	Southern Okanogan Basin	**SOB**
	Southern Okanogan Highland	**SOH**
NORTHERN CASCADE RANGES	Hozameen Range	**HOR**
	Okanagan Range	**OKR**
THOMPSON-OKANAGAN PLATEAU	Northern Okanagan Basin	**NOB**
	Northern Okanagan Highland	**NOH**
	Northern Thompson Upland	**NTU**
	Southern Thompson Upland	**STU**
	Thompson Basin	**THB**
BOREAL PLAINS		
CENTRAL ALBERTA UPLAND	Clear Hills	**CLH**
	Halfway Plateau	**HAP**
SOUTHERN ALBERTA UPLAND	Kiskatinaw Plateau	**KIP**
PEACE RIVER BASIN	Peace Lowland	**PEL**
TAIGA PLAINS		
HAY RIVER LOWLAND	Fort Nelson Lowland	**FNL**
MUSKWA PLATEAU		**MUP**
NORTHERN ALBERTA UPLAND	Etsho Plateau	**ETP**
	Maxhamish Upland	**MAU**
	Petitot Plain	**PEP**
NORTHERN BOREAL MOUNTAINS		
HYLAND HIGHLAND		**HYH**
LIARD BASIN	Liard Plain	**LIP**
NORTHERN CANADIAN ROCKY MOUNTAINS	Eastern Muskwa Ranges	**EMR**
	Muskwa Foothills	**MUF**
	Western Muskwa Ranges	**WMR**
BOREAL MOUNTAINS AND PLATEAUS	Cassiar Ranges	**CAR**
	Kechika Mountains	**KEM**
	Southern Boreal Plateau	**SBP**
	Stikine Plateau	**STP**
	Teslin Plateau	**TEP**
	Tuya Range	**TUR**
SOUTHERN YUKON LAKES	Teslin Basin	**TEB**
ST. ELIAS MOUNTAINS	Icefield Ranges	**ICR**
YUKON-STIKINE HIGHLANDS	Tagish Highland	**TAH**
	Tahltan Highland	**THH**
	Tatshenshini Basin	**TAB**

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 (2)

SOIL CLASS. (6) | HUMUS FORM (7) | 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) | (33)

ORGANIC HORIZONS/LAYERS

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

MINERAL HORIZONS/LAYERS

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

NOTES: (34)

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 (see tab numbers on sample form, facing page)

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

5 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 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.

TABLE 2.1. Sedimentary rock codes

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

	General	Code	Specific	Code
Precipitates, crystalline	Calcareous	**pk**	Travertine	**tv**
			Limestone	**ls**
			Dolomite	**do**
	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

Four information fields are provided for recording terrain texture, surficial material, surface expression and geomorphological process, respectively (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).

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

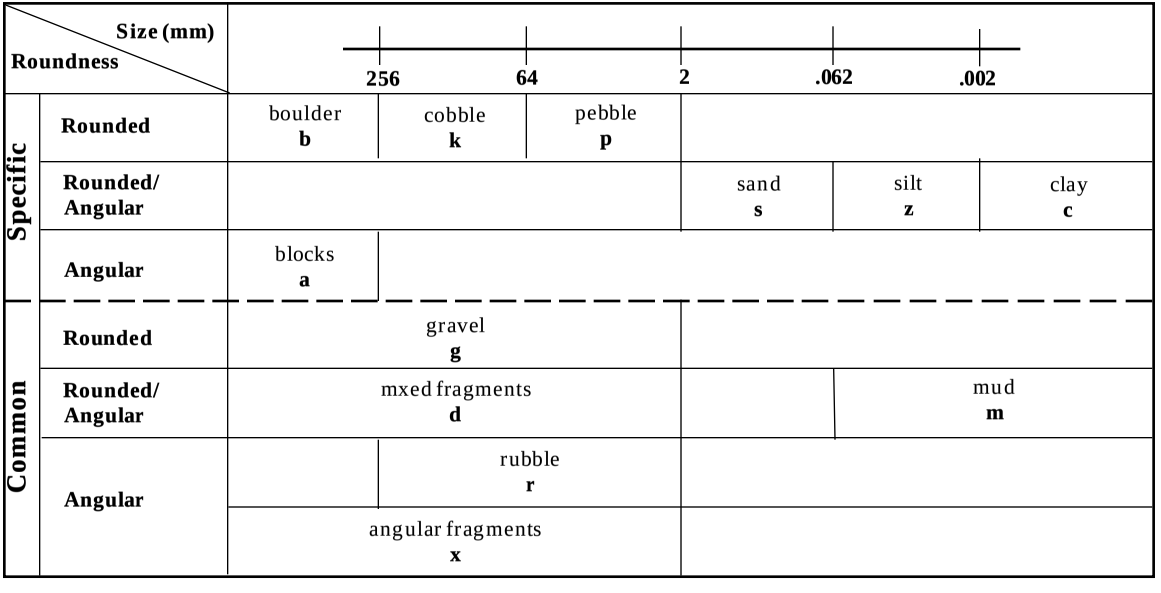


FIGURE 2.1. Relationship of size and roundness of the clastic textural terms.

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; > 15° to < 26°
b	Blanket	A mantle of unconsolidated materials; > 1 m thick
c	Cone(s)	A cone or segment of a cone; > 15°
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; 15–35°
j	Gentle slope	Unidirectional surface; > 3° and ≤ 15°
k	Moderately steep slope	Unidirectional surface; > 26° and < 35
m	Rolling	Elongate hillocks; 3–15°; parallel forms in plan view
p	Plain	Unidirectional surface; up to 3°
r	Ridge(s)	Elongate hillocks; 15–35°; parallel forms in plan view
s	Steep slope	Steep slopes; > 35°
t	Terrace(s)	Step-like topography
u	Undulating	Hillocks and hollows; up to < 15°; 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	A dominance of very thin surficial materials about 2–20 cm thick

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

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 nivation processes 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 Appendix 2.1. Appendix 2.2 includes a key to soil orders. For those wishing to use family and phase criteria, refer to Soil Classification Working Group (1998) and include in "Notes."

7. Humus Form

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. Appendix 2.3 contains a key to humus forms. For those wishing to use phases, refer to Green et.al. (1993), and include in "Notes."

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**

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 the element group code (where applicable) second (e.g., Fra= alluvial river). Subsystem codes are only presented for lacustrine, palustrine, and fluvial sites; those for other systems are under development. Use the codes in Tables 2.10 and 2.11.

TABLE 2.10. Codes for hydrogeomorphic systems

Code	System	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 2.11. 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.

System	Element Group	Code	Description
	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.
	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.

System	Element Group	Code	Description
	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 2.12). Where rooting is restricted to the organic horizons, use the organic material codes in Table 2.12. 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
($\geq$ 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.

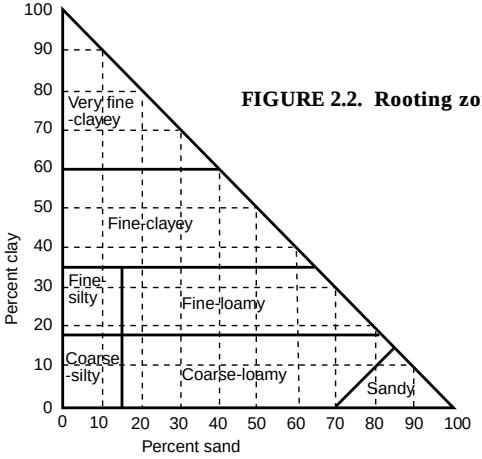


FIGURE 2.2. Rooting zone particle size classes.

TABLE 2.12. 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 %		
S	Sandy	Organic Material Codes:
CL	Coarse-loamy	**F** Fibric
FL	Fine-loamy	**M** Mesic
CSI	Coarse-silty	**H** Humic
FSI	Fine-silty	**W** Woody
FC	Fine-clayey	
VFC	Very-fine-clayey	

[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 2.13), and the depth (cm) from the *ground surface* down to the top of the layer.

TABLE 2.13. 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 2.14.

TABLE 2.14. 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 "**NP**" 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 (Table 2.15.) s

TABLE 2.15. Drainage classes and codes

Code	Class	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	Class	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 2.16). Record the subclass code in the "drainage" information field.

TABLE 2.16. 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 2.17 and 2.18). 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 2.17. 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 2.18. 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 2.19.

TABLE 2.19. 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

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 in mineral soils are measured upward from zero depth (e.g., L 12–9, Fm 9–2, and Ah 2–0), and in organic soils they are measured downward from the ground surface, or uppermost soil 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 2.20) in the first column and the "kind" code (Table 2.21) in the second column.

TABLE 2.20. Degree of aggregation codes

Code	Class	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 2.21. Kind of aggregation codes

Code	Class	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 2.22).

TABLE 2.22. 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 2.23.

TABLE 2.23. Mycelial abundance classes and codes

Code	Class	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 2.24.

TABLE 2.24. Fecal abundance classes and codes

Code	Class	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 2.25). 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 2.25. 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 2.26), and the determined values for each horizon to one decimal place.

TABLE 2.26. 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 2.27 to describe consistency.

TABLE 2.27. Consistency classes and codes

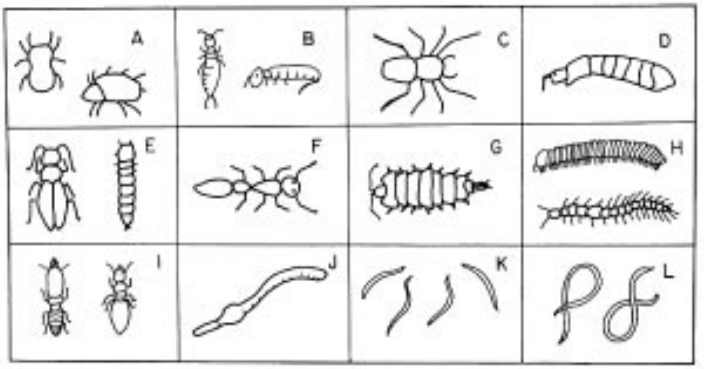
Code	Class	Description
LO	Loose	Material has no consistence
FR	Friable	Material crumbles easily under gentle pressure
FM	Firm	Material can be crushed under moderate pressure; resistance is noticeable
PL	Pliable	Material is soft and plastic
RE	Resilient	Material is springy or elastic; assumes its original 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 2.28 to describe character.

TABLE 2.28. Character classes and codes

Code	Class	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^{o} 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 2.29.

TABLE 2.29. Colour aspects and codes for mineral soils

Code	Aspect	Description
1 **2**	Matrix moist Matrix dry	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.
3 **4**	Exped moist Exped dry	Colour of ped surfaces in soils with moderately durable peds which may be broken open and examined.
5 **6**	Inped moist Inped dry	Dominant colour of ped interiors in soils with moderately durable peds that may be broken open and examined.
7 **8**	Crushed moist Crush dry	Soil material is crushed and mixed. Surface of the sample is smoothed to reduce irregularities that affect colour.

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). See Appendix 2.4 for a key to soil texture (and letter-code descriptions).

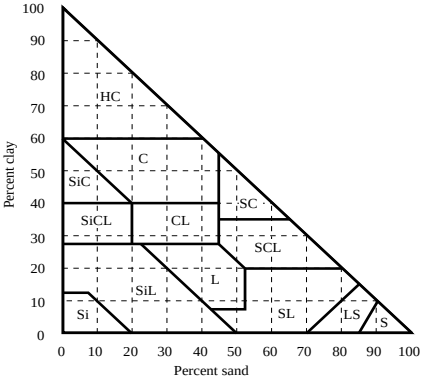


FIGURE 2.4. Soil texture triangle.

28. Percent Coarse Fragments

Estimate the percent coarse fragment (> 2 mm diameter) volume in each size class and record the total percent. Describe the coarse fragment shape using the type codes in Table 2.30.

TABLE 2.30. 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.

29. Roots

Describe roots by noting their abundance and size (Table 2.31). Record the most abundant size first; secondary roots can be recorded by using a slash (/) in the columns (see example in Item 21).

TABLE 2.31. 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 2.32 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 2.32. 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

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 2.33 and 2.34). 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 2.33. 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 2.34. 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.

Code	Description
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.
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 2.35 and 2.36). Most Bt horizons will exhibit clay films and should be noted. For example, *FMTK clay films* = Few, moderately thick clay films.

TABLE 2.35. 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.

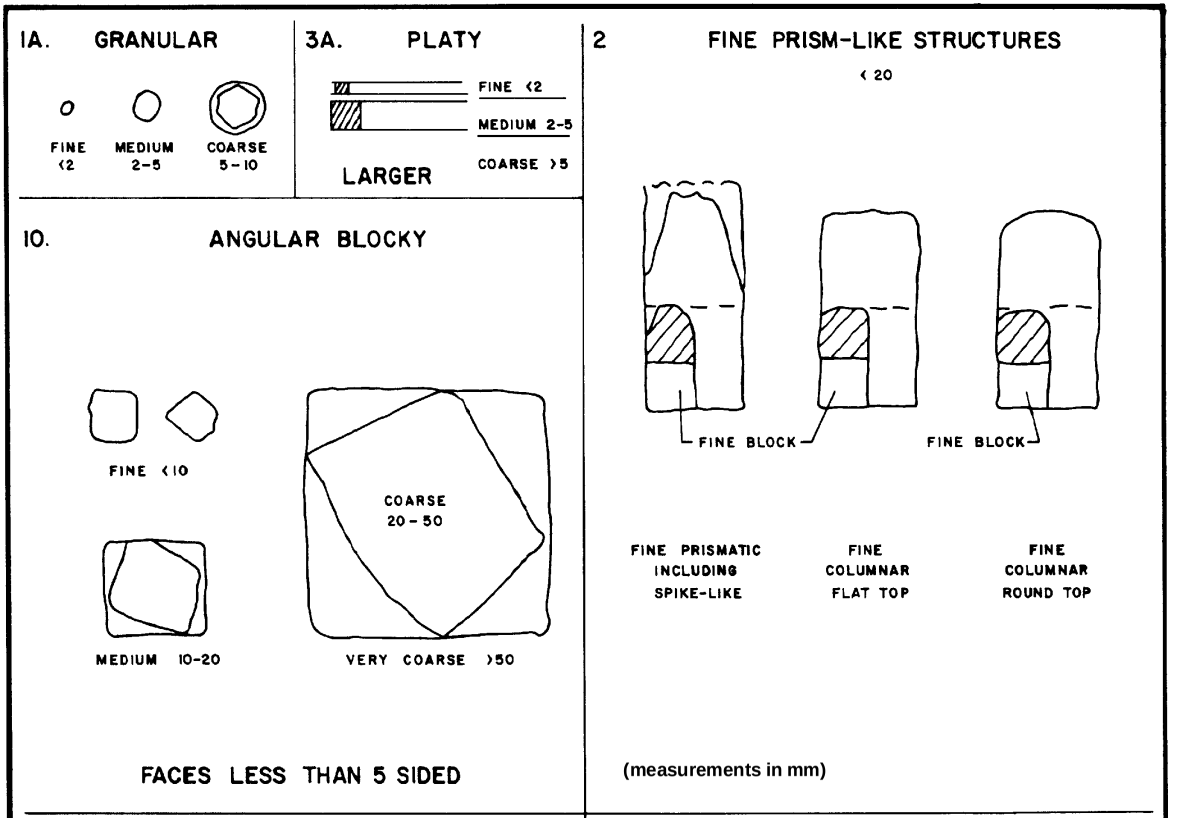


FIGURE 2.5. Diagrammatic representation of soil structure.

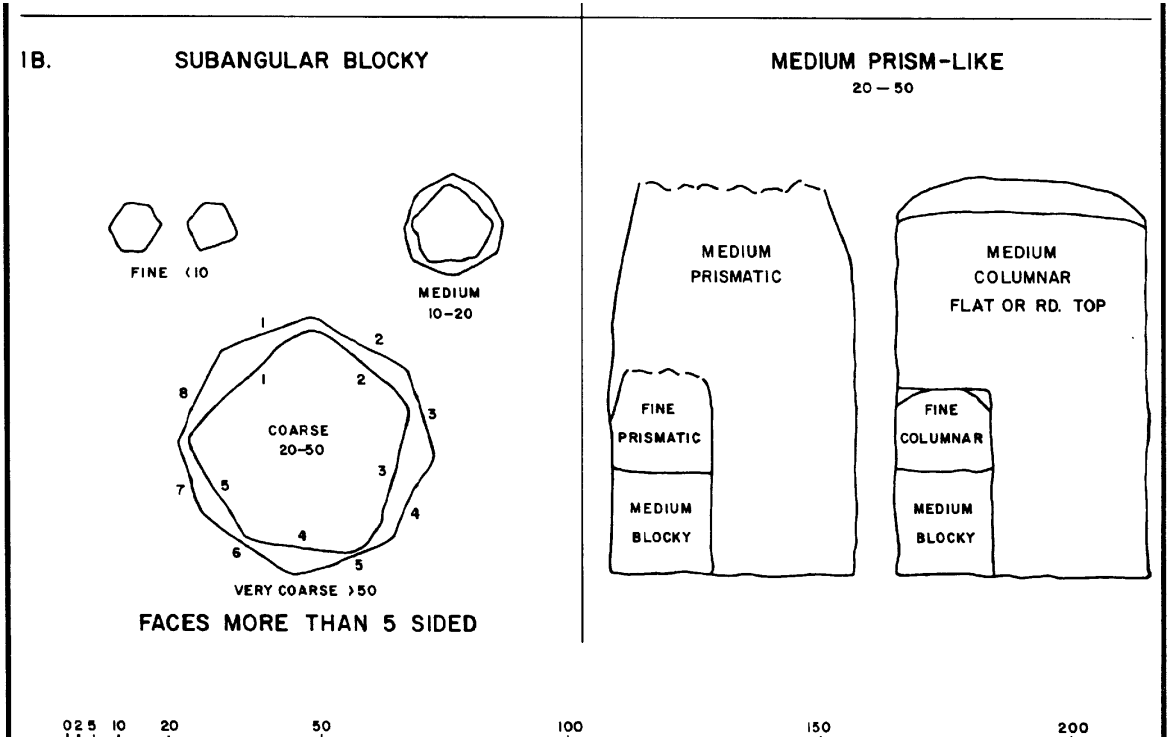


FIGURE 2.5. (continued).

TABLE 2.36. 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 2.37.

TABLE 2.37. 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 2.38.

TABLE 2.38. 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.

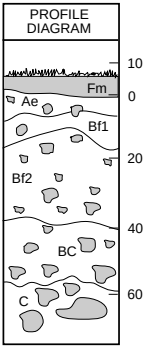


FIGURE 2.6. Example of profile diagram.

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

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

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

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

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

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

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

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

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

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

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 Key to Soil Orders

Key to Soil Orders (Soil Classification Working Group 1998)

A. Soils that have permafrost within 100 cm of the surface, or 200 cm if strongly cryoturbated. ..... **Cryosolic Order**

B. Other soils with:
   1. Organic horizons (more than 17% organic C by mass) that extend from the surface to one of the following:
      a. A depth of 60 cm or more if the surface layer is fibric material (Of) having a bulk density of < 0.075 g / cm^3.
      b. A depth of 40 cm or more if the surface layer consists of mesic or humic material (Om or Oh) having a bulk density ≥ 0.075 g / cm^3.
      c. A depth of more than 40 cm if composed of folic materials (L, F, and H), or at least 10 cm if a lithic contact or fragmental materials are present. Folic materials must be more than twice the thickness of a mineral soil layer if the mineral layer is less than 20 cm thick.

   OR

   2. One or more mineral horizons or layers within 40 cm of the surface in addition to the organic horizons (O) as follows:
      a. If a mineral horizon or layer thinner than 40 cm occurs at the surface, the underlying organic horizon or horizons must have a total thickness of at least 40 cm.
      b. If one or more mineral horizons or layers occur within 40 cm of the surface, the organic material must occupy more than 40 cm of the upper 80 cm of the control section.

      ..... **Organic Order**

C. Other soils that have both a vertic horizon and a slickenside horizon, the top of which occurs within 1 m of the surface. ... **Vertisolic Order**

D. Other soils that have a podzolic B horizon and do not have a Bt horizon within 50 cm of the mineral surface. ..... **Podzolic Order**

E. Other soils that are saturated with water and under reducing conditions either continuously or during some period of the year as indicated either by direct measurements of the water table and the oxidation-reduction status, or by any of the following morphological features within 50 cm of the mineral surface:

1. For all but red soil materials (hue 5YR or redder and colour fades slowly on dithionite treatment).

    a. Chromas of 1 or less, without mottles, on ped surfaces or in the matrix if peds are lacking in materials that develop higher chromas under oxidizing conditions.
    b. Chromas of 2 or less, in hues of 10YR and 7.5YR, on ped surfaces or in the matrix if peds are lacking, accompanied by prominent mottles.
    c. Chromas of 3 or less, in hues yellower than 10YR, on ped surfaces or in the matrix if peds are lacking, accompanied by prominent mottles.
    d. Hues bluer than 10Y, with or without mottles, on ped surfaces or in the matrix if peds are lacking. ..... **Gleysolic Order**

2. Other soils that have a solonetzic B horizon. ..... **Solonetzic Order**

G. Other soils that have a chernozemic A horizon and any one of the following:
1. No Ae horizon.
2. A weakly expressed Ae horizon (Aej) with a dry colour value lower than 5.
3. An Ae horizon thinner than an overlying Ah or Ap horizon that does not appear to be eluviated.
4. An Ae horizon not more than 5 cm thick if the chernozemic A is eluviated (Ahe), as indicated by grey streaks and splotches when the soil is dry. ..... **Chernozemic Order**

H. Other soils that have a Bt horizon. ..... **Luvisolic Order**

I. Other soils that have either Bm, Btj, or Bfj horizons at least 5 cm thick, or a Bf horizon less than 10 cm in thickness. ..... **Brunisolic Order**

J. Other soils. ..... **Regosolic Order**

Appendix 2.3 Key to Humus Forms

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)**

Appendix 2.4 Key to Soil Texture

Soil texture field tests

Graininess Test Rub the soil between your fingers. If sand is present, it will feel "grainy." Determining whether sand constitutes more or less than 50% of the sample is the first decision in the key.

Moist Cast Test Compress some moist 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, the more clay is present.

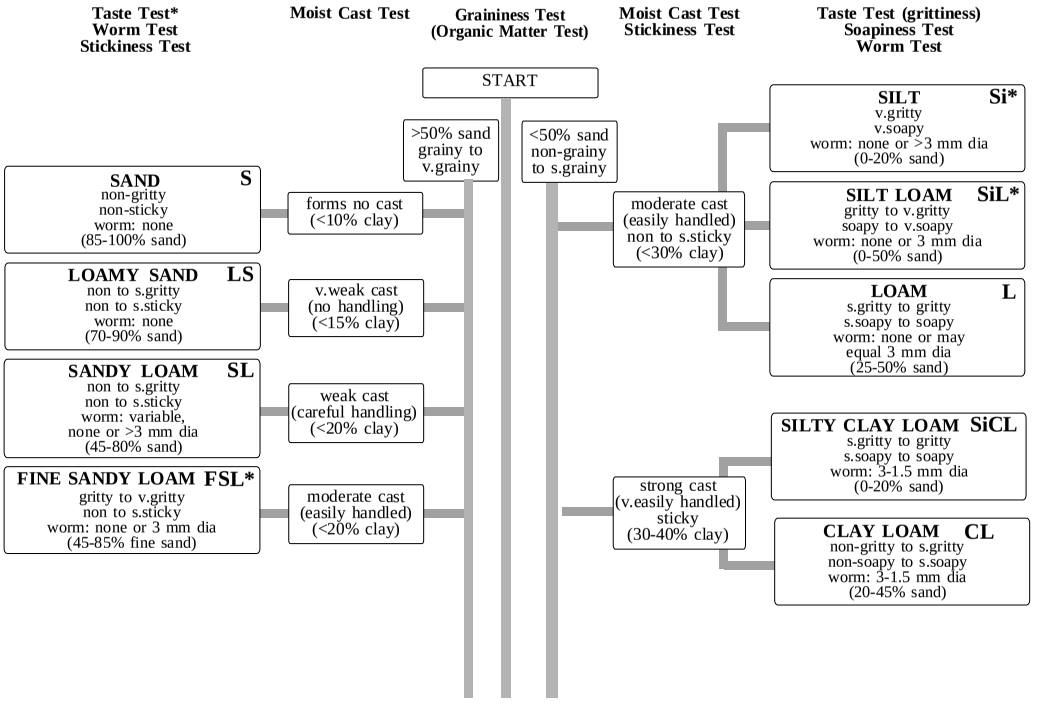
Stickiness Test Moisten the soil thoroughly and compress it between thumb and forefinger. Determine degree of stickiness by noting how strongly the soil adheres to the thumb and forefinger when pressure is released, and how much it stretches. Stickiness increases with clay content.

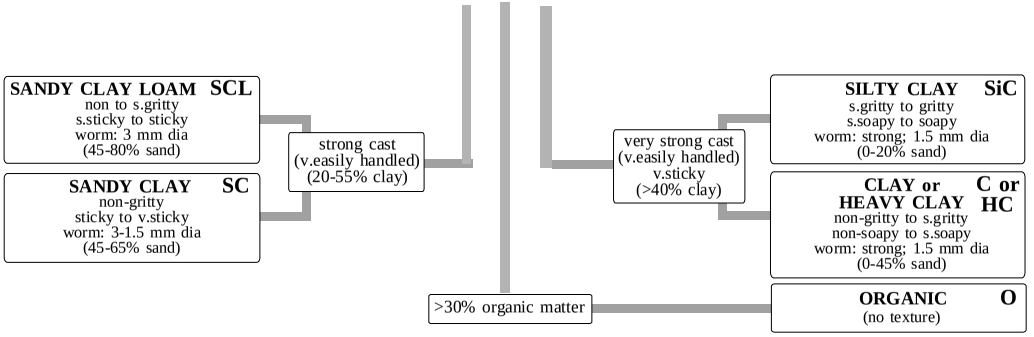
Worm Test Roll some moist soil between the palms of your hands to form the longest, thinnest worm possible. The more clay present, the longer, thinner and more durable the worm will be.

Taste Test (Not recommended due to health concerns) Work a small amount of moist soil between your front teeth. Silt particles are distinguished as fine "grittiness," unlike sand which is distinguished as individual grains (i.e., graininess). Clay has no grittiness.

Well-decomposed organic matter imparts silt-like properties to the soil. However, when subjected to the taste test, it feels non-gritty. It is generally very dark in colour when moist or wet, and stains the hands brown or black. This organic matter is not used as a determinant of soil texture; an estimate of the silt content of humus-enriched mineral soils should be reduced accordingly.

Soapiness Test Work a small amount of wet soil between your thumb and fingers. Silt feels slick and not too sticky (i.e., clay) or grainy (i.e., sand); the greater the dominance of a slick feel, the greater the silt content.


Taste Test*
Worm Test
Stickiness Test
Moist Cast Test
Graininess Test
(Organic Matter Test)
Moist Cast Test
Stickiness Test
Taste Test (grittiness)
Soapiness Test
Worm Test
START
>50% sand
grainy to
v.grainy
<50% sand
non-grainy
to s.grainy
SAND S
non-gritty
non-sticky
worm: none
(85-100% sand)
forms no cast
(<10% clay)
LOAMY SAND LS
non to s.gritty
non to s.sticky
worm: none
(70-90% sand)
v.weak cast
(no handling)
(<15% clay)
SANDY LOAM SL
non to s.gritty
non to s.sticky
worm: variable,
none or >3 mm dia
(45-80% sand)
weak cast
(careful handling)
(<20% clay)
FINE SANDY LOAM FSL*
gritty to v.gritty
non to s.sticky
worm: none or 3 mm dia
(45-85% fine sand)
moderate cast
(easily handled)
(<20% clay)
moderate cast
(easily handled)
non to s.sticky
(<30% clay)
strong cast
(v.easily handled)
sticky
(30-40% clay)
SILT Si*
v.gritty
v.soapy
worm: none or >3 mm dia
(0-20% sand)
SILT LOAM SiL*
gritty to v.gritty
soapy to v.soapy
worm: none or 3 mm dia
(0-50% sand)
LOAM L
s.gritty to gritty
s.soapy to soapy
worm: none or may
equal 3 mm dia
(25-50% sand)
SILTY CLAY LOAM SiCL
s.gritty to gritty
s.soapy to soapy
worm: 3-1.5 mm dia
(0-20% sand)
CLAY LOAM CL
non-gritty to s.gritty
non-soapy to s.soapy
worm: 3-1.5 mm dia
(20-45% sand)



* Silt feels slippery or soapy when wet; fine sand feels stiffer, like grinding compound or fine sandpaper.

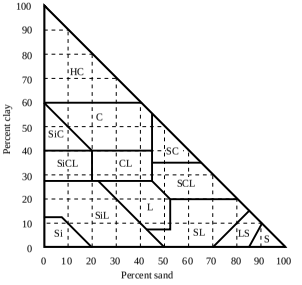
Key to Abbreviations

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



3 VEGETATION

Contents

Tables

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VEGETATION

SPP. LIST COMP. ☐ PART. ☐ (1)

% COVER BY LAYER (2) TREE (A) ☐ SHRUB (B) ☐ HERB (C) ☐ MOSS / LICHEN (D) ☐

SURVEYOR(S) (3)

PLOT NO. (4)

PAGE (5) OF

TREES (6)	A1	A2	A3	A	B1	B2	B

SHRUBS (7)	B1	B2	B

HERB LAYER (C) (8)	%

MOSS / LICHEN / SEEDLING (D) (9)	%

ADDITIONAL SPECIES (10)	LAYER	%

NOTES: (11)

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 MOF 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:

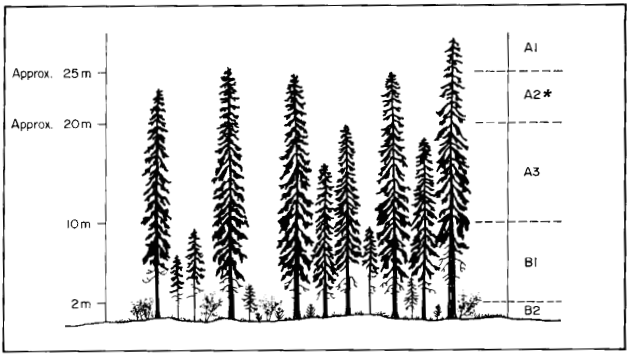
B1 **Tall shrub layer** - includes all woody plants 2–10 m tall, including shrubs and advance tree regeneration and trees in poorly growing stands where the canopy is less than 10 m high.

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.

E. The *epiphyte layer* includes all species which grow on other living plants.



**some exceptions for very low growing stands*

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

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. 1998). 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. 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.

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

Latin Name	Latin Name
*Andromeda polifolia**	*Kalmia microphylla**
Anemone multifida	*Linnaea borealis**
Apocynum androsaemifolium	*Lithospermum incisum*
Apocynum cannabinum	*Lithospermum ruderale*
Apocynum medium	*Loiseleuria procumbens**
Apocynum sibiricum	*Luetkea pectinata**
*Arctostaphylos alpina**	*Orthilia secunda*
*Arctostaphylos uva-ursi**	*Oxycoccus oxycoccos**
Aruncus dioicus	*Penstemon davidsonii**
Asclepias ovalifolia	*Penstemon ellipticus**
Asclepias speciosa	*Phlox caespitosa*
*Cassiope lycopodioides**	*Phyllodoce empetriformis**
*Cassiope mertensiana**	*Phyllodoce glanduliflora**
*Cassiope stelleriana**	*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 polaris**
Eriogonum niveum	*Salix reticulata**
Eriogonum ovalifolium	*Salix stolonifera**
Eriogonum pauciflorum	*Saxifraga bronchialis*
Eriogonum umbellatum	*Saxifraga cespitosa*
Frageria chiloensis	*Saxifraga flagellaris*
Fragaria vesca	*Saxifraga oppositifolia*
Fragaria virginiana	*Saxifraga tricuspidata*
Galium boreale	*Sibbaldia procumbens*
*Gaultheria hispidula**	*Vaccinium caespitosum**
*Gaultheria humifusa**	*Vaccinium scoparium**
*Gaultheria ovatifolia**	*Vaccinium vitis-idaea**
Geocaulon lividum	*Vaccinium myrtillus**

* low woody species

Plants Growing on Subdominant Substrates

Where the objectives of a study or the features of a particular site warrant collecting data for plants growing on substrates other than the dominant substrate, list these 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).

TABLE 3.2. Codes for subdominant substrates

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

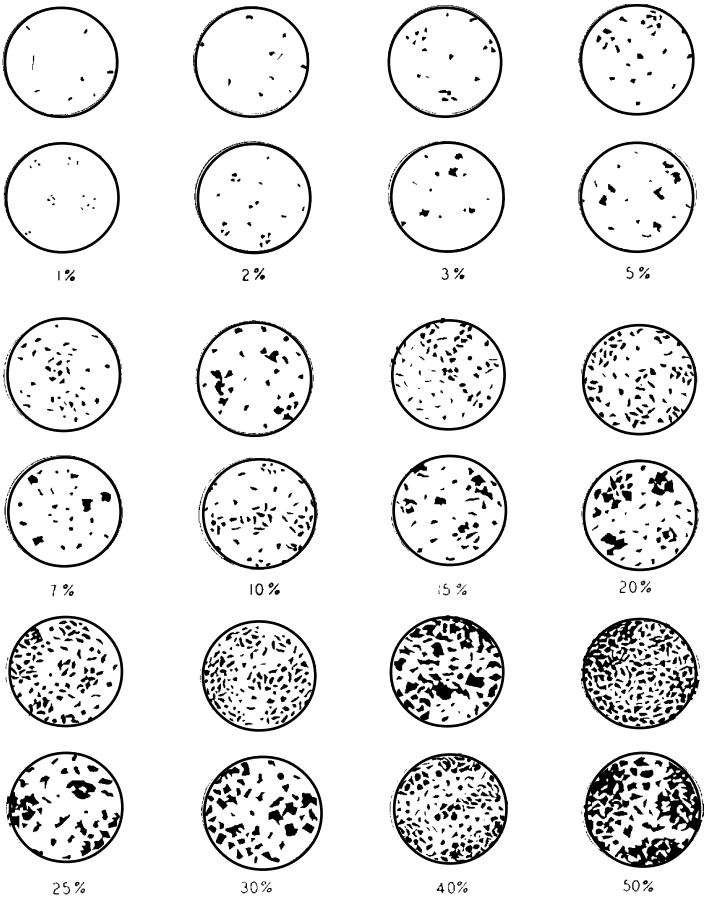


FIGURE 3.2. Comparison charts for visual estimation of foliage cover.

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

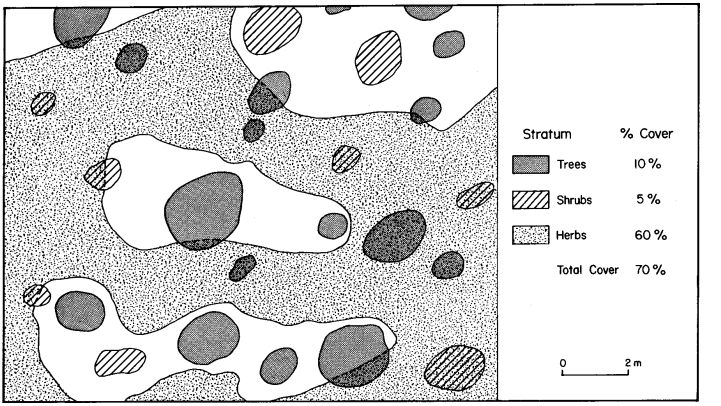


FIGURE 3.3. An example of percent coverages in a plot, viewed from above.

Recording Percent Cover

Percent cover may be entered in whole numbers (1–100), tenths of a percent (0.1–0.9), hundredths of a percent (recorded as 1H–9H), and thousandths of a percent (recorded as 1T– 9T). 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.

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

Dimensions	Area (m^2)	% cover	Coding
10 x 10 m	100.0	25.0	25
5 x 8 m	40.0	10.0	10
2 x 2 m	4.0	1.0	1
63 x 63 cm	0.4	0.1	0.1
20 x 20 cm	0.04	0.01	1H
6.3 x 6.3 cm	0.004	0.001	1T

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**), phenology (**PV** or **PG**), utilization (**UT**), estimates of available forage (**AF**), and arboreal lichen loading (**LL**). 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. Trees

Estimate percent cover for each tree species by sub-layer and layer (A1, A2, A3, A, B1, B2, B). If trees in A1 are veterans, record this under Item 11, "Notes." For each of the A and B layers, the total percent coverage for a species will often be less than the sum of the covers for each of the sub-layers, due to crown overlap.

7. Shrubs

Estimate percent cover for each shrub species by sub-layer (B1 and B2), and as a total for the species (B). The total percent coverage of a species will often be less than the sum of the two sub-layer values due to overlap of foliage.

8. Herb Layer

Estimate percent cover for each species in the herb (C) layer.

9. Moss, Lichen, and Seedling Layer

Estimate percent cover for each moss, lichen, and seedling species in this layer (D).

10. Additional Species

Use these lines 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 species growing on subdominant substrates.

11. 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)

If a "Tree Attributes for Wildlife" form is not required, a general assessment of lichen loading can be recorded by tree species on the vegetation description form. Assess standing live and dead trees for lichen loading on the 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.

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)
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

(over)

Code	Description	No. plants[a] in 400 m^2
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 unfolded
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

4 MENSURATION

Contents

Appendices *Page*

Tables

Figures

MENSURATION

MENSURATION FORM

SURVEYOR(S): (1)

TREE#	SPP.	DBH	HEIGHT CALCULATIONS						HT. TO DBH	TOTAL HT.	BH AGE	SI	SUP.	CONK	BL. CONK	SCAR.	F. OR C.	F. CRACK	MISTLE.	R. BRAN.	D. OR B. TOP	DAMAGE		SITE SERIES
			TOP	BOT.	SD	SL.	HD	HT.														TYPE	SEV.	
(2)	(3)	(4)				(5)					(6)	(7)	(8)				(9)					(10)		(11)

NOTES

TREE DIAMETER TALLY

TREE #	SPP.	DBH	TREE #	SPP.	DBH

Field Procedure

Getting Started

1. Establish plot boundaries.
2. Traverse the plot systematically to identify candidate sample trees according to project objectives. If largest diameter trees are being sampled, use Tree Diameter Tally to assist in selection.
3. 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 name(s) of persons collecting mensuration data.
2. Record tree numbers and species of sample trees.
3. Examine each tree for evidence of suppression, pathological indicators, and pests or injury. If present, and if determining the site index is a primary objective of the project, select a different sample that is free of defects (if possible). If site index is not a primary objective, or no alternate defect-free trees exist, retain the sample and enter coding as appropriate.
4. Determine and record diameters and age at breast height. If age is to be determined later, place the collected core in a labelled straw.
5. Determine and record measurements for height calculations.
6. Calculate height, total height, and site index (or leave blank and calculate using *SiteTools* software and the data entry program VENUS).
7. If the site is variable, identify the site series code for the area around each tree, in consultation with other surveyors.
8. Check that all the required information has been collected and noted on the form. Strike through any fields that were not assessed.

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. Tree Number

Assign numbers sequentially to each tree sampled. Start with the tree closest to due north of plot centre and proceed clockwise. Numbers may be painted or tagged on trees.

3. Species

Identify tree species using the codes given in Appendix 4.1.

4. Diameter at Breast Height

Record DBH (diameter at breast height) to the nearest 0.1 cm. Measure at 1.3 m above the point of germination. On slopes, measure from the high side of the root collar.

5. Height Calculations

Record the following measurements: heights and distances in metres and slopes in percent. Tree height can be calculated in the field using equations and tables provided, or automatically using the data entry program "VENUS."

Slope to top of tree (TOP):
Enter the percent slope reading to the top of the tree, showing the sign (usually "+"). If a reading greater than 100% is obtained, move further from the tree, or upslope.

Slope to DBH or base of tree (BOT):
Enter the percent slope reading to DBH, or to the base of the tree, or to lowest visible point, including the sign ("+" or "–"). The maximum allowable is 100%.

Slope distance (SD):
Enter the distance (in metres, to one decimal) from the observer to the centre of the tree trunk, usually at breast height.

Slope (SL):
Enter the slope gradient between the observer and the tree at breast height (the slope of the measuring tape used to determine slope distance). This value is used in height calculations done by "VENUS."

Horizontal distance (HD):
Calculate this by multiplying slope distance (SD) by a slope distance factor from Table 4.1. The slope percent column in this table refers to the slope gradient measurement Slope (SL).

Height (HT):
Enter the height (m) of the measured part of the tree to one decimal, calculated as follows:
$HT = [(TOP - BOT) \times HD] \div 100$

Height to DBH (HT TO DBH):
If the BOT reading was not taken at the base of the tree, record the height at which it was taken. This is usually DBH, but can be another value. Enter "0" if taken at the base of tree.

TABLE 4.1. Slope distance factors

% slope	Factor	% slope	Factor	% slope	Factor
10	.995	36	.941	62	.849
11	.994	37	.938	63	.846
12	.993	38	.935	64	.842
13	.992	39	.932	65	.838
14	.990	40	.928	66	.834
15	.989	41	.925	67	.830
16	.987	42	.922	68	.827
17	.986	43	.919	69	.823
18	.984	44	.915	70[a]	.819
19	.982	45	.912	75	.800
20	.980	46	.908	80	.781
21	.979	47	.905	85	.762
22	.977	48	.902	90	.743
23	.974	49	.898	95	.725
24	.972	50	.894	100	.707
25	.970	51	.890	105	.690
26	.968	52	.887	110	.673
27	.965	53	.883	115	.656
28	.963	54	.880	120	.640
29	.960	55	.876	125	.625
30	.958	56	.872	130	.610
31	.955	57	.868	135	.595
32	.952	58	.865	140	.581
33	.950	59	.861	150	.555
34	.941	60	.857		
35	.944	61	.853		

[a] Interpolate for slopes between 70 and 150%.

Total height (TOTAL HT) :
The total height of the tree = HT + HT TO DBH

Note the following example calculation:

TOP = +62, BOT = –24, TOP – BOT = 62–(–24) = 86
SD = 20.5 m, SL = 23%, slope distance factor (from table) = 0.974
HD = SD × slope distance factor = 20.5 × 0.974 = 20.0
HT = [(TOP – BOT) × HD] ÷ 100 = (86 × 20.0) ÷ 100 = 17.2 m
HT TO DBH = 1.3 m
Total height = HT + HT TO DBH = 17.2 + 1.3 = 18.5 m

6. Age at Breast Height

Measure age at breast height, 1.3 m above the ground on the high side. 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.

7. Site Index

Calculate site index (reference age 50) using the *Site Tools (version 3)* software available from MOF Research Branch.

8. Suppression

Ideally, trees selected for measurement should be free of suppression. If this is not the case, indicate by entering an "**S"** here, otherwise leave blank.

9. 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.

TABLE 4.2. 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

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.

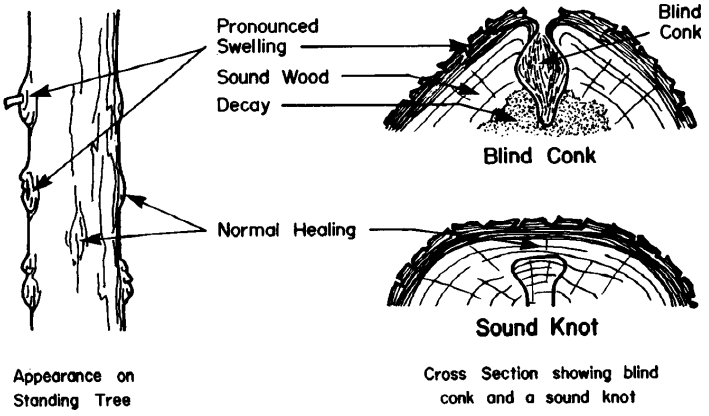


FIGURE 4.1. Blind conk and sound knot, on a standing tree and in cross-section.

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.

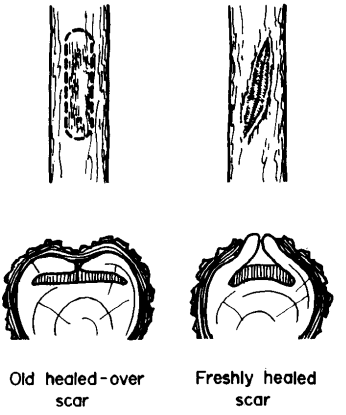


FIGURE 4.2. Appearance of scars that are old or freshly healed.

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).

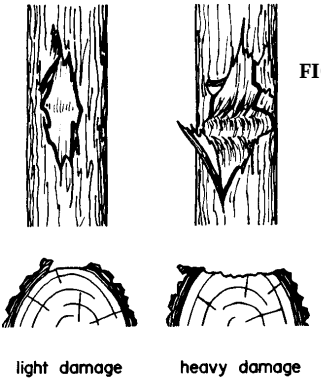


FIGURE 4.3. Appearance of scars with light or heavy damage.

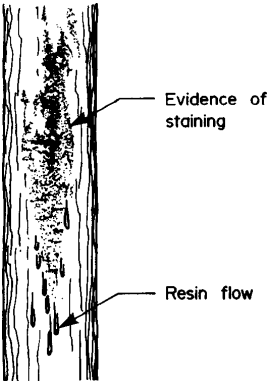


FIGURE 4.4. Appearance of cankers caused by fungi.

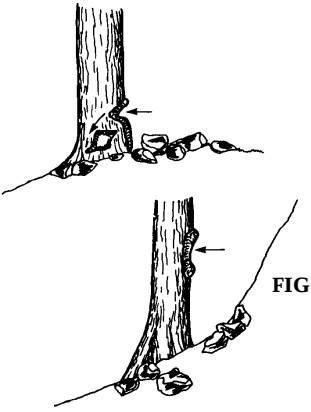


FIGURE 4.5. Appearance of scars caused by rock slides or falling rock.

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.

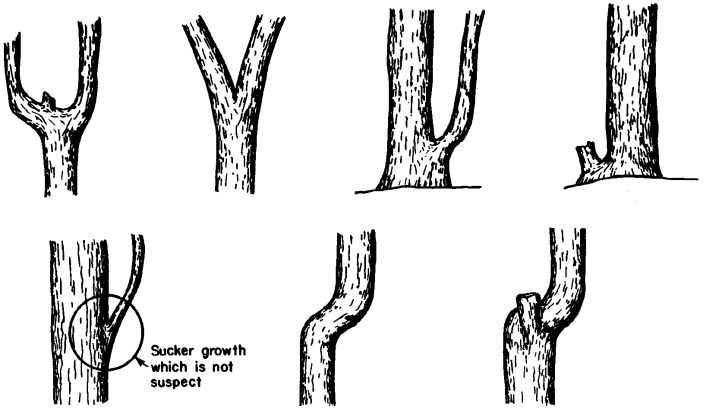


FIGURE 4.6. Appearance of different forms of forks and crooks.

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).

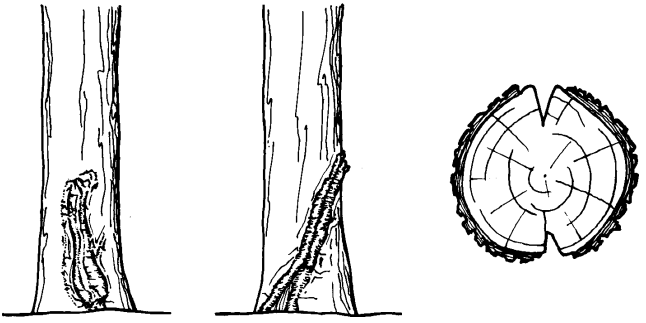


FIGURE 4.7. Appearance of frost crack on standing tree and in cross-section.

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).

(A) **(B)**

FIGURE 4.8. Examples of mistletoe infection.

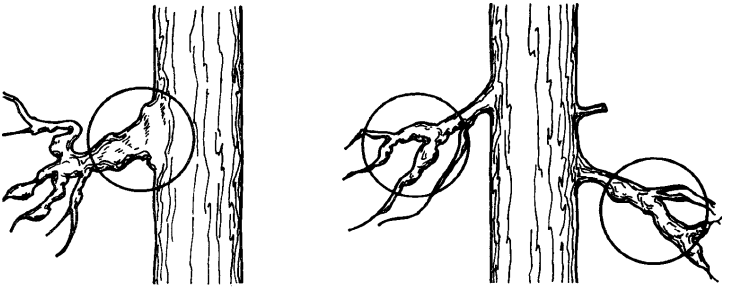


FIGURE 4.9. How to determine if mistletoe infection causes tree to be suspect.

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-grown trees (see Figure 4.10B).

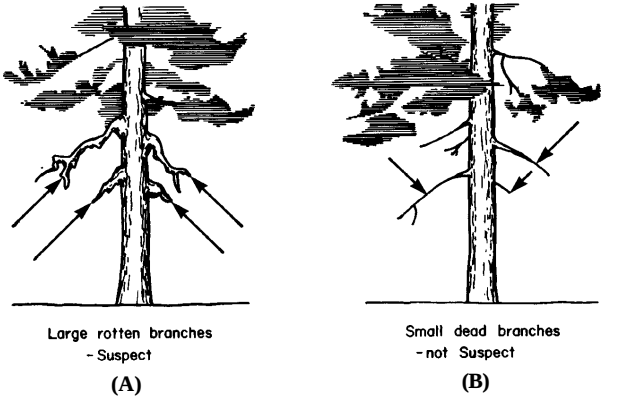


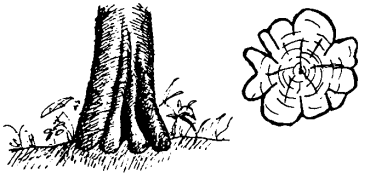
FIGURE 4.10. How to determine if rotten branches are a probable indicator of decay.

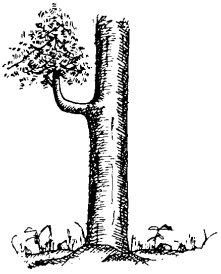
Dead or broken top (D. or B. Top):
These may be caused by wind, snow, mechanical damage from other falling trees, etc. Only note those not recent in origin (i.e., must be obviously weathered).

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.

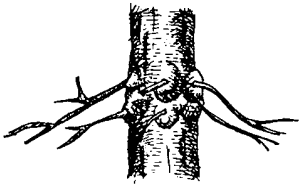
Flutes Pronounced flutes in the trunk (illustrated right) are characteristic of many species and do not signify decay.



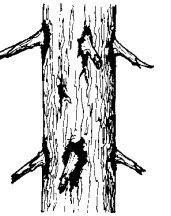


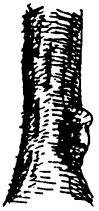
Candelabra branches Candelabra branches (illustrated left) develop as a result of abnormal branch growth and do not signify decay. They may be confused with suspect forking; unlike forks, however, they do not originate in the trunk of a tree.

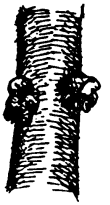
Branch fans A branch fan (illustrated right) develops through abnormal branching, appearing most commonly as a 'fan' of branches which originates from a burl-like swelling on the trunk. These are not considered suspect.



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.



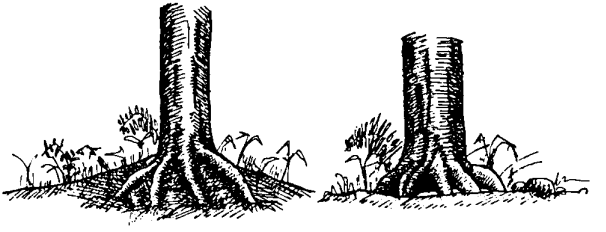




Burls and galls Burls and galls (illustrated left) develop from abnormal cell growth in trees. Although formidable in appearance, they do not signify decay.

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

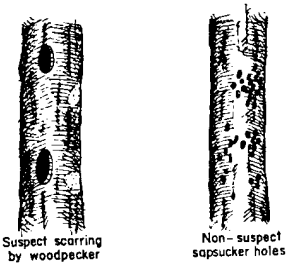
Exposed roots Exposed roots and buttress roots (shown below) do not signify decay unless scarring is present above the point of germination.



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.



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

10. Damage

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 Appendix 4.2.

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

11. Site Series

If the site is variable, enter the site series code for the area in a 4 m radius around the tree.

APPENDIX 4.1 Tree Species Codes

Conifers

Common name	Species	Code
Cedar	*Thuja*	
western redcedar	*T. plicata*	Cw
Cypress	*Chamaecyparis*	
yellow-cedar	*C. nootkatensis*	Yc
Douglas-fir	*Pseudotsuga*	
Douglas-fir	*P. menziesii*	Fd
interior Douglas-fir	*P. menziesii* var. *glauca*	Fdi
coast Douglas-fir	*P. menziesii* var. *menziesii*	Fdc
Fir (Balsam)	*Abies*	
amabilis fir	*A. amabilis*	Ba
grand fir	*A. grandis*	Bg
subalpine fir	*A. lasiocarpa*	Bl
Hemlock	*Tsuga*	
mountain hemlock	*T. mertensiana*	Hm
western hemlock	*T. heterophylla*	Hw
mountain x western hemlock hybrid	*T. mertensiana* x *heterophylla*	Hxm
Juniper	*Juniperus*	
Rocky Mountain juniper	*J. scopulorum*	Jr
Larch	*Larix*	
alpine larch	*L. lyallii*	La
tamarack	*L. laricina*	Lt
western larch	*L. occidentalis*	Lw
Pine	*Pinus*	
whitebark pine	*P. albicaulis*	Pa
limber pine	*P. flexilis*	Pf
jack pine	*P. banksiana*	Pj
lodgepole pine	*P. contorta*	Pl
lodgepole x jack pine hybrid	*P.* x *murraybanksiana*	Pxj
shore pine	*P. contorta* var. *contorta*	Plc
lodgepole pine	*P. contorta* var. *latifolia*	Pli
western white pine	*P. monticola*	Pw
ponderosa pine	*P. ponderosa*	Py
Spruce	*Picea*	
black spruce	*P. mariana*	Sb
Engelmann spruce	*P. engelmannii*	Se
white spruce	*P. glauca*	Sw
Sitka spruce	*P. sitchensis*	Ss
spruce hybrid	*Picea* cross	Sx

Conifers

Common name	Species	Code
Engelmann x white	*P. engelmannii* x *glauca*	Sxw
Sitka x white	*P.* x *lutzii*	Sxl
Sitka x unknown	*P. sitchensis* x *?*	Sxs
Yew	*Taxus*	
western yew	*T. brevifolia*	Tw

Hardwoods

Common name	Species	Code
Alder	*Alnus*	
red alder	*A. rubra*	Dr
Apple	*Malus*	
Pacific crab apple	*Malus fusca*	Up
Aspen, Cottonwood, Poplar	*Populus*	
poplar	*P. balsamifera*	Ac
balsam poplar	*P. b.* ssp. *balsamifera*	Acb
cottonwood	*P. b.* ssp. *trichocarpa*	Act
hybrid poplar	*P.* spp.	Ax
trembling aspen	*P. tremuloides*	At
Arbutus	*Arbutus*	
arbutus	*A. menziesii*	Ra
Birch	*Betula*	
Alaska paper birch	*B. neoalaskana*	Ea
Alaska x paper birch hybid	*B.* x *winteri*	Exp
paper birch	*B. papyrifera*	Ep
water birch	*B. occidentalis*	Ew
Cascara	*Rhamnus*	
cascara	*R. purshiana*	Kc
Cherry	*Prunus*	
bitter cherry	*P. emarginata*	Vb
pin cherry	*P. pensylvanica*	Vp
choke cherry	*P. virginiana*	Vv
Dogwood	*Cornus*	
western flowering dogwood	*C. nuttallii*	Gp
Maple	*Acer*	
bigleaf maple	*A. macrophyllum*	Mb
vine maple	*A. circinatum*	Mv
Oak	*Quercus*	
Garry oak	*Q. garryana*	Qg

Hardwoods

Common name	Species	Code
Willow	*Salix*	
peach-leaf willow	*S. amygdaloides*	Wa
Bebb's willow	*S. bebbiana*	Wb
pussy willow	*S. discolor*	Wd
Pacific willow	*S. lucida*	Wp
Scouler's willow	*S. scouleriana*	Ws
Sitka willow	*S. sitchensis*	Wt

Others

Common name	Species	Code
Unknown		
Unknown conifer		Xc
Unknown hardwood		Xh
Other tree, not on list		
Other conifer		Zc
Other hardwood		Zh

Exotics[1]

Common name	Species	Code
Apple	*Malus*	
apple	*Malus pumila*	Ua
Aspen, Cottonwood or Poplar	*Populus*	
*southern cottonwood	*P. deltoides*	Ad
Birch	*Betula*	
European birch	*B. pendula*	Ee
silver birch	*B. pubescens*	Es
Cherry	*Prunus*	
sweet cherry	*P. avium*	Vs
Cypress	*Chamaecyparis*	
*Port Orford-cedar	*C. lawsoniana*	Yp
Fir (Balsam)	*Abies*	
*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*	
*Siberian larch	*L. siberica*	Ls
Maple	*Acer*	
box elder	*A. negundo*	Me

Exotics[1]

Common name	Species	Code
*Norway maple	*A. platanoides*	Mn
*Sycamore maple	*A. pseudoplatanus*	Ms
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
Pine	*Pinus*	
*Monterey pine	*P. radiata*	Pm
*red pine	*P. resinosa*	Pr
*sugar pine	*P. lambertiana*	Ps
Oak	*Quercus*	
*English oak	*Q. robur*	Qe
Spruce	*Picea*	
*Norway spruce	*P. abies*	Sn

[1] (*) Introduced species not known to occur on Crown Land, but requiring a code for database purposes, are indicated with an asterisk.

APPENDIX 4.2 Damage Agent Codes

Damage agent code			Description
A			**Animal Damage**
	AB		Bear
	AC		Cattle
	AD		Deer
	AE		Elk
	AH		Hare or rabbit
	AM		Moose
	AP		Porcupine
	AS		Squirrel
	AV		Vole
	AX		Birds
	AZ		Beaver
D			**Diseases**
	DB		**Broom rusts**
		DBF	Fir broom rust *Melampsorella caryophyllacearum*
		DBS	Spruce broom rust *Chrysomyxa arctostaphyli*
	DD		**Stem rot**
		DDA	Artists conk *Ganoderma applanatum*
		DDB	Birch trunk rot *Fomes fomentarius*
		DDC	Cedar brown pocket rot *Poria sericeomollis*
		DDD	Sulfur fungus *Laetiporus sulphureus*
		DDE	Rust-red stringy rot *Echinodontium tinctorium*
		DDF	Brown crumbly rot *Fomitopsis pinicola*
		DDH	Hardwood trunk rot *Phellinus igniarius*
		DDP	Red ring rot *Phellinus pini*
		DDQ	Quinine conk rot *Fomitopsis officinalis*
		DDS	Schweinitzii butt rot *Phaeolus schweinitzii*
		DDT	Aspen trunk rot *Phellinus tremulae*
	DF		**Foliage Disease**
		DFA	Western pine aster rust *Coleosporium asterum*
		DFC	Large-spored spruce-Labrador tea rust *Chrysomyxa ledicola*
		DFD	Spruce needle cast *Lirula macrospora*
		DFE	Elytroderma needle rust *Elytroderma deformans*
		DFH	Larch needle cast *Hypodermella laricis*

Damage agent codes		Description
	DFL	Pine needle cast *Lophodermella concolor*
	DFM	Larch needle blight *Meria laricis*
	DFP	Fir-fireweed rust *Pucciniastrum epilobii*
	DFR	Douglas-fir needle cast *Rhabdocline pseudotsugae*
	DFS	Redband needle blight *Mycosphaerella scirrhia pini*
	DFT	Sirococcus tip blight *Sirococcus strobilinus*
	DFU	Cedar leaf blight *Didymascella thujina*
DL		**Disease-caused Dieback of Leader**
	DLD	Dermea canker *Dermea pseudotsugae*
	DLF	Red flag disease *Potebniamyces balsamicola*
	DLP	Phomopsis canker *Phomopsis lokoyae*
	DLS	Sydowia (sclerophoma) tip dieback *Sclerophoma pithyophila*
	DLV	Aspen-poplar twig blight *Venturia* spp.
DM		**Dwarf Mistletoe**
	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 Disease**
	DRA	Armillaria root disease *Armillaria ostoyae*
	DRB	Black stain root disease *Leptographium wageneri*
	DRC	Laminated root rot, cedar strain *Phellinus weirii*
	DRL	Laminated root rot *Phellinus weirii*
	DRN	Annosus root disease *Heterobasidion annosum*
	DRR	Rhizina root disease *Rhizina undulata*
	DRT	Tomentosus root rot *Inonotus tomentosus*
DS		**Stem Disease (Bark Cankers and Rusts)**
	DSA	Atropellis canker (Lodgepole pine) *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 *Hypoxylon mammatum*
	DSP	Cryptospaeria populina *Cryptospaeria populina*
	DSR	Ceratocystis canker *Ceratocystis fimbriata*

Damage agent codes			Description
		DSS	Stalactiform blister rust *Cronartium coleosporioides*
		DST	Nectria canker *Nectria galligena*
		DSY	Cytospora canker *Cytospora chrysosperma*
I			**Insects**
	IA		**Aphids**
		IAB	Balsam woolly adelgid *Adelges piceae*
		IAC	Giant conifer aphid *Cinara* spp.
		IAG	Cooley spruce gall adelgid *Adelges cooleyi*
		IAL	Larch cone wooly aphid *Adelges lariciatus*
		IAS	Spruce aphid *Elatobium abietinum*
		IAX	Gall aphids or woolly aphids *Adelges spp.*
	IB		**Bark Beetles**
		IBB	Western balsam bark beetle *Dryocetes confusus*
		IBD	Douglas-fir beetle *Dendroctonus pseudotsugae*
		IBI	Engraver beetles *Ips* spp.
		IBM	Mountain pine beetle *Dendroctonus ponderosae*
		IBP	Twig beetles *Pityogenes, Pityophthorus* spp.
		IBS	Spruce beetle *Dentroctonus rufipennis*
		IBT	Red turpentine beetle *Dendroctonus valens*
		IBW	Western pine beetle *Dendroctonus brevicomis*
	ID		**Defoliators**
		IDA	Black army cutworm *Actebia fennica*
		IDB	2-year cycle budworm *Choristoneura biennis*
		IDC	Larch casebearer *Coleophora laricella*
		IDD	Western winter moth *Erannis tiliaria vancouverensis*
		IDE	Eastern spruce budworm *Choristoneura fumiferana*
		IDF	Forest tent caterpillar *Malacosoma disstria*
		IDG	Greenstriped forest looper *Melanolophia imitata*
		IDH	Western blackheaded budworm *Acleris gloverana*
		IDI	Pine needle sheath miner *Zellaria haimbachi*
		IDL	Western hemlock looper *Lambdina fiscellaria lugubrosa*
		IDM	Gypsy moth *Lymantria dispar*
		IDN	Birch leaf miner *Fenusa pusilla*
		IDP	Larch sawfly *Pristiphora erichsoni*
		IDR	Red 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*

Damage agent codes			Description
		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 piniiopis*
		ISP	Pitch nodule moths *Petrova* spp.
		ISQ	Sequoia pitch moth *Vespamina sequoiae*
		ISS	Western pine shoot borer *Eucosma sonomana*
	IW		**Root and Terminal Weevils**
		IWC	Conifer seedling weevil *Steremnius carinatus*
		IWM	*Magdalis spp.*
		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 weevils *Cylindrocopturus* spp.
		IWZ	Yosemite bark weevil *Pissodes schwartzi*
	M		**Mites** *Trisetacus* spp.
N			**Non-biological Injuries**
	NB		Fire
	ND		Drought
	NF		Flooding
	NG		Frost
		NGC	Frost crack
		NGH	Frost heaved
		NGK	Shoot / bud frost kill
	NH		Hail
	NK		Fumekill
	NL		Lightning
	NN		Road salt
	NR		Redbelt
	NS		Slide

Damage agent codes			Description
	NW		Windthrow
		NWS	Windthrow soil failure
		NWT	Windthrow treatment or harvesting related
	NY		Snow or ice (includes snow press)
	NZ		Sunscald
O			**No Detectable Abiotic or Biotic Damage**
T			**Treatment Injuries**
	TC		Chemical
	TH		Harvested
	TL		Logging
	TP		Planting
		TPM	Poor microsite planting
	TM		Other mechanical damage (non-logging)
	TR		Pruning
	TT		Thinning or spacing
V			**Vegetation Problems**
	VH		Herbaceous competition
	VP		Vegetation press
	VS		Shrub competition
	VT		Tree competition

5 WILDLIFE HABITAT ASSESSMENT

Contents

BRITISH COLUMBIA

WILDLIFE HABITAT ASSESSMENT

Proj. id. (1) | Date y (2) 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 (7)	Sp. L.R. (8)	Ssn.	FD	SH (9)	TH	Com.	Habitat feature	Conf.	Distance (km)	F/C L.R.	Imp. (10)	Habitat feature	Conf.	Distance (km)	F/C L.R.	Imp.	FD	SH	TH	Suit. (11)	Com. (12)

Comments / Notes

FS 882 (5) HRE 98/5

BRITISH COLUMBIA

WILDLIFE HABITAT ASSESSMENT

Project id. | Plot no.

Evidence of Use

Species	Inside plot: Sex	Life Stage	Activity	Des.	No.	Com.	Outside plot and inside ecosystem unit: 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)

FS 882 (5) HRE 98/5

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 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
A	All seasons	**WE**[a]	Early Winter
G	Growing	**WL**[a]	Late 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. This 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 B.C.

Class	Suitability/ capability	Lower limit (%)	Upper limit (%)	Quality
1	High	> 75	≤100	Equivalent
2	Mod. high	> 50	≤ 75	Slightly less
3	Moderate	> 25	≤ 50	Moderately less
4	Low	> 5	≤ 25	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 *	Alkaline pond	Body of fresh water with a pH greater than 7 and a depth less than 2 m[1]
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 *	Beach	Area of sorted sediments reworked in recent time by wave action; at the edge of fresh or salt water bodies[2]
BF *	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[1]
BU	Building	
CA *	Canal	Artificial watercourse created for transport, drainage, and/or irrigation purposes
CB *	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[2]
CF *	Cultivated field	Flat or gently rolling, non-forested, open area subject to human agricultural practices

Code	Habitat feature	Definition
CH	Clearcut, herbaceous	
CL *	Cliff	Steep, vertical or overhanging rock face[3]
CO *	Cultivated orchard	Agricultural area of fruit trees planted in rows
CS	Clearcut, shrubby	
CU	Clearcut, unvegetated	
CV *	Cultivated vineyard	Agricultural area of grapes planted in rows
ES *	Exposed soil	Area of exposed soil; not included in any of the other definitions[2]
ET	Electrical transmission line	
EY	Estuary	
FC	Forest, commercially thinned	
FE	Fence	
FM	Forest, mature	
FO	Forest, old	
FY	Forest, young	
GB *	Gravel bar	Elongated landform generated by waves and currents; a mix of cobbles, pebbles, stones, and / or sand
GC *	Golf course	Grass-covered fairways and open areas for the playing of golf
GL *	Glacier	Mass of perennial snow and ice[2]
GP *	Gravel pit	Area exposed for the removal of sand and gravel[2]
GR	Grassland	

Code	Habitat feature	Definition
LA *	Lake	Naturally occurring, static body of water > 2 m deep (> 50 ha)[2]
LB *	Lava bed	Area where molten rock has flowed from a volcano or fissure and cooled to form solidified rock[2]
MI *	Mine	Unvegetated area for the extraction of mineral ore and other materials[1]
MO *	Moraine	Unvegetated landform of unstratified glacial drift[4]
MU *	Mudflat sediment	Flat plain-like areas of fine-textured sediment[2]
NB	Nest boxes	
OT	Other	
OW *	Shallow open water	Wetland of permanent shallow open water (< 2 m deep); lacking extensive emergent plant cover
PA	Pasture	
PD *	Pond	A small body of water > 2 m deep (< 50 ha)
PI	Pipeline right-of-way	
PS *	Permanent snow	Snow or ice, not part of a glacier, but found during summer months[2]
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 *	Reservoir	Artificial basin created by the impoundment of water behind a human-made structure such as a dam, berm, dyke, or wall[2]
RI *	River	Watercourse formed when water flows between continuous, definable banks[2]
RN *	Railway surface	Roadbed with fixed rails for possibly single or multiple rail lines[2]

Code	Habitat feature	Definition
RO *	Rock outcrop	Gentle to steep, bedrock escarpment or outcropping, with little soil development and sparse vegetation
RP*	Road surface	Area cleared and compacted for vehicle transport[2]
RR *	Rural	Area of residences and other human developments scattered and intermingled with forest, range, farm land, and native vegetation or cultivated crops[1]
RU *	Rubble	Small angular rock fragments (between 2 and 256 mm) deposited by gravity or ice[2, 4]
SW *	Saltwater	Body of water that contains salt or is considered to be salty[2]
TA*	Talus	Large angular rock fragments at the foot of steep rock slopes as a result of successive rock falls[2, 4]
UR *	Urban / suburban	Area of residences and other human developments form an almost continuous cover[1]
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] To identify old, mature and young forest, refer to definitions provided in Item 23, Site Description section.

* 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.

1 adapted from Dunster and Dunster (1996)

2 adapted from Resources Inventory Committee (1997)

3 adapted from Sinnemon (1994)

4 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 available 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 kilometers, the distance from plot center 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	Definition
F	Food	Provides habitat used for consuming food items, including searching for and consuming food simultaneously such as is done by grazers, browsers, flying insectivores, ducks, and other species with similar feeding habits; includes habitat used for searching for, pursuing and killing prey

Code	Food / cover life requisite	Definition
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 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 or neonate	Nestling birds and newly hatched or newborn 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 their 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	Life stage is unknown

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 parts	Incidental portions of an animal's body which are left behind, but do not indicate the animal 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 conspecific 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

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 disturbance 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

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	Behavior 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

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 center
- Stand at the plot center 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 center 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.

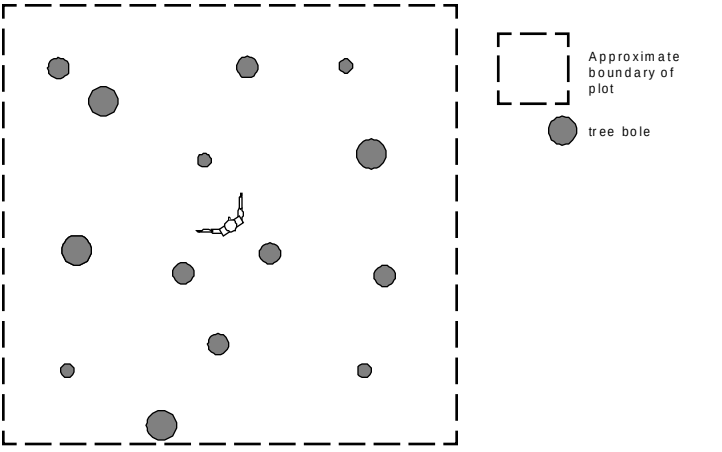


FIGURE 5.1. Top view of biologist standing at center of plot and estimating the area covering a quarter of the plot and the number of trees in a quarter plot.

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.

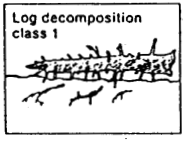
30. Sampled __ of 30 m Transect

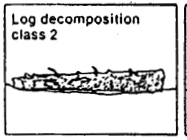
Indicate the length of the line that was sampled. The form has room to record 22 pieces of CWD. If more than 22 pieces are encountered on a 30 m transect, discontinue the transect and record the number of metres that were sampled to reach 22 pieces. If the entire line was sampled, indicate that all 30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

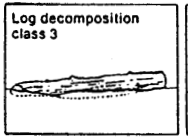
31. Decay Class

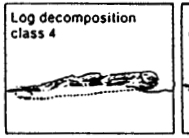
Assign a decay class (1 to 5) based on the majority condition of each piece encountered along the transect. See Table 5.13 for descriptions of classes.

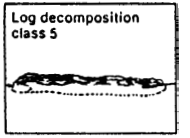
TABLE 5.13. Decay classes for coarse woody debris











	Class 1	Class 2	Class 3	Class 4	Class 5
Portion on Ground	Elevated on support points	Elevated but sagging slightly	Sagging near ground, or broken	All of log on ground, sinking	All of log on ground, partly sunken
Twigs < 3 cm (if originally present)	Present	Absent	Absent	Absent	Absent
Bark	Intact	Intact or partly missing	Trace	Absent	Absent
Shape	Round	Round	Round	Round to oval	Oval
Texture	Intact, hard	Intact, hard to partly decaying	Hard, large pieces, partly decaying	Small, blocky pieces	Many small pieces, soft portions
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)	Code	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
CM	Constant management required (every 2-5 years)
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 Latin 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 asterix 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

Contents

Page

Appendix

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				Estimated length (m)	Cr. Class	Height to live crown (m)	Wildlife Codes						Comments
						Top (%)	Bot (%)	Bot pos (m)	Slope Distance (m)				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 5																			
0 6																			
0 7																			
0 8																			
0 9																			
1 0																			
1 1																			
1 2																			
1 3																			
1 4																			
1 5																			
1 6																			
1 7																			
1 8																			
1 9																			
2 0																			

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 Appendix 6.1.

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 ÷ 60 × 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.

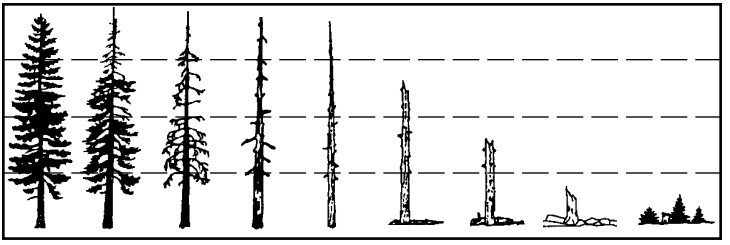


FIGURE 6.1. Visual appearance codes for wildlife trees.

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)

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).

APPENDIX 6.1 Tree Species Codes[1]

Conifers

Common name	Species	Code
Cedar	*Thuja*	
western redcedar	*T. plicata*	Cw
Cypress	*Chamaecyparis*	
yellow-cedar	*C. nootkatensis*	Yc
Douglas-fir	*Pseudotsuga*	
Douglas-fir	*P. menziesii*	Fd
interior Douglas-fir	*P. menziesii* var. *glauca*	Fdi
coast Douglas-fir	*P. menziesii* var. *menziesii*	Fdc
Fir (Balsam)	*Abies*	
amabilis fir	*A. amabilis*	Ba
grand fir	*A. grandis*	Bg
subalpine fir	*A. lasiocarpa*	Bl
Hemlock	*Tsuga*	
mountain hemlock	*T. mertensiana*	Hm
western hemlock	*T. heterophylla*	Hw
mountain x western hemlock hybrid	*T. mertensiana* x *heterophylla*	Hxm
Juniper	*Juniperus*	
Rocky Mountain juniper	*J. scopulorum*	Jr
Larch	*Larix*	
alpine larch	*L. lyallii*	La
tamarack	*L. laricina*	Lt
western larch	*L. occidentalis*	Lw
Pine	*Pinus*	
whitebark pine	*P. albicaulis*	Pa
limber pine	*P. flexilis*	Pf
jack pine	*P. banksiana*	Pj
lodgepole pine	*P. contorta*	Pl
lodgepole x jack pine hybrid	*P.* x *murraybanksiana*	Pxj
shore pine	*P. contorta* var. *contorta*	Plc
lodgepole pine	*P. contorta* var. *latifolia*	Pli
western white pine	*P. monticola*	Pw
ponderosa pine	*P. ponderosa*	Py
Spruce	*Picea*	
black spruce	*P. mariana*	Sb
Engelmann spruce	*P. engelmannii*	Se
white spruce	*P. glauca*	Sw
Sitka spruce	*P. sitchensis*	Ss
spruce hybrid	*Picea* cross	Sx

Conifers

Common name	Species	Code
Engelmann x white	*P. engelmannii* x *glauca*	Sxw
Sitka x white	*P.* x *lutzii*	Sxl
Sitka x unknown	*P. sitchensis* x *?*	Sxs
Yew	*Taxus*	
western yew	*T. brevifolia*	Tw

Hardwoods

Common name	Species	Code
Alder	*Alnus*	
red alder	*A. rubra*	Dr
Apple	*Malus*	
Pacific crab apple	*Malus fusca*	Up
Aspen, Cottonwood, Poplar	*Populus*	
poplar	*P. balsamifera*	Ac
balsam poplar	*P. b.* ssp. *balsamifera*	Acb
cottonwood	*P. b.* ssp. *trichocarpa*	Act
hybrid poplar	*P.* spp.	Ax
trembling aspen	*P. tremuloides*	At
Arbutus	*Arbutus*	
arbutus	*A. menziesii*	Ra
Birch	*Betula*	
Alaska paper birch	*B. neoalaskana*	Ea
Alaska x paper birch hybid	*B.* x *winteri*	Exp
paper birch	*B. papyrifera*	Ep
water birch	*B. occidentalis*	Ew
Cascara	*Rhamnus*	
cascara	*R. purshiana*	Kc
Cherry	*Prunus*	
bitter cherry	*P. emarginata*	Vb
pin cherry	*P. pensylvanica*	Vp
choke cherry	*P. virginiana*	Vv
Dogwood	*Cornus*	
western flowering dogwood	*C. nuttallii*	Gp
Maple	*Acer*	
bigleaf maple	*A. macrophyllum*	Mb
vine maple	*A. circinatum*	Mv
Oak	*Quercus*	
Garry oak	*Q. garryana*	Qg

Hardwoods

Common name	Species	Code
Willow	*Salix*	
peach-leaf willow	*S. amygdaloides*	Wa
Bebb's willow	*S. bebbiana*	Wb
pussy willow	*S. discolor*	Wd
Pacific willow	*S. lucida*	Wp
Scouler's willow	*S. scouleriana*	Ws
Sitka willow	*S. sitchensis*	Wt

Others

Common name	Species	Code
Unknown		
Unknown conifer		Xc
Unknown hardwood		Xh
Other tree, not on list		
Other conifer		Zc
Other hardwood		Zh

[1] Additional codes for exotic tree species available from B.C. Ministry of Forests, Research Branch. Also noted in Appendix 4.1

7 COARSE WOODY DEBRIS

Contents

BRITISH COLUMBIA

Date y (2) m d

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

COARSE WOODY DEBRIS

Transect #1

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

Tree No.	Species	Diameter (cm)	Class	Tilt Angle	Length (m)	Height of end (cm)	Angle grnd.
01	(6)	(7)	(8)	(9)	(10)	(11)	(12)
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	Diameter (cm)	Class	Tilt Angle	Length (m)	Height of end (cm)	Angle grnd.

Degree and Type of Piling (in plot boundaries)

Pile #	Size of pile (m) length	width	height	Diam (cm)	Inter. spac.
1					
2	(13)				
3					
4					
5					
6					
7					
8					

Comments

FS 882 (7) HRE 98/5

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 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 90º 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, record their equivalent diameter.
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;
- 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;
- material that is buried beneath organic or mineral soil layers or has decomposed enough to be part of the forest floor; and,
- live or dead trees (still rooted) which are self supporting.

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 90º 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).

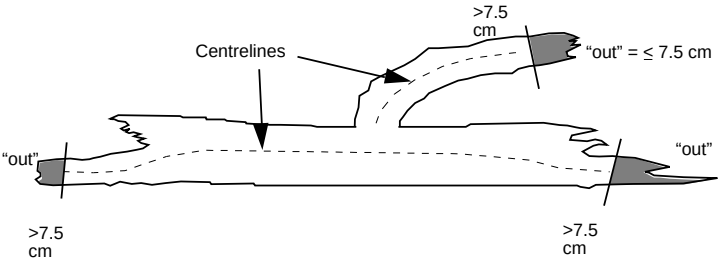


FIGURE 7.1a

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

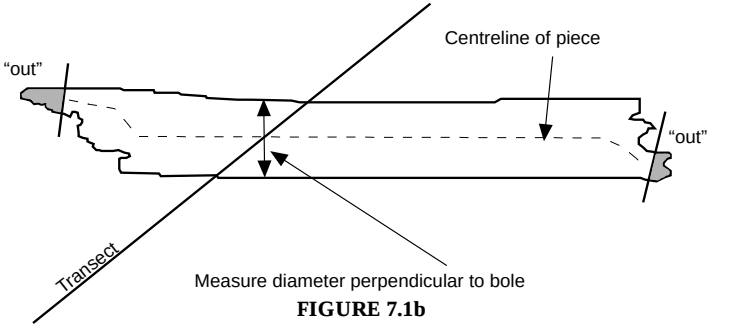


FIGURE 7.1b

- 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).

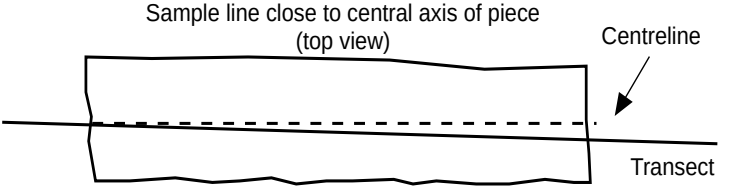


FIGURE 7.1c

- If the transect intersects a curved or angular piece more than once, measure each intersection as a separate observation (see 7.1d).

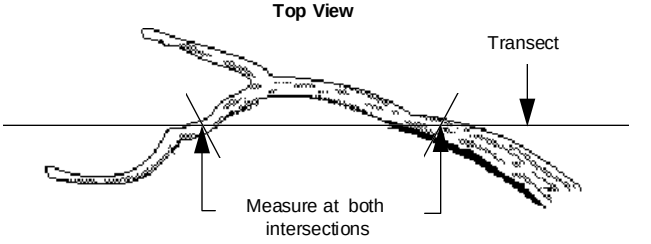


FIGURE 7.1d

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.

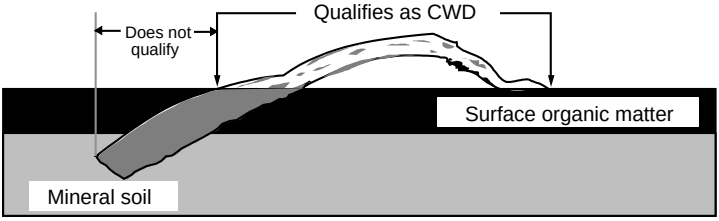


FIGURE 7.2. Tally only coarse woody debris that lies above the soil.

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.

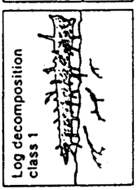
5. Line Length
Record the distance that was actually sampled (Sampled ___ of 24 m) out of the total distance, in the spaces provided.

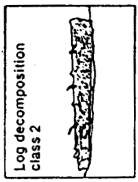
6. Species
Record code for each piece, using tree species codes found in Appendix 7.1. If the species can not be determined put “X” for unknown, “Xh” for unknown hardwood, or “Xc” for unknown conifer.

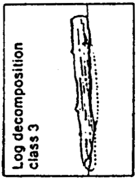
7. Diameter
Record the diameter of the piece perpendicular to the bole at the point where the sampling line is considered to intersect the central axis of the piece. Wrap a diameter tape around the bole, when possible, or use the reverse side of the tape to estimate the diameter. Calipers may also be 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.

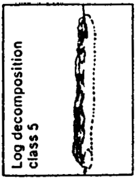
8. Class
Assign a decay class (1 to 5) based on the majority condition of the entire piece. The five classes used to describe the condition of coarse woody debris are based primarily upon wood texture, and secondarily on other characteristics. See Table 7.1 for descriptions of classes.

TABLE 7.1. Decay classes for coarse woody debris









	Class 1	**Class 2**	**Class 3**	**Class 4**	**Class 5**
Wood Texture	Intact, hard	Intact, hard to partly decaying	Hard, large pieces, partly decaying	Small, blocky pieces	Many small pieces, soft portions
Portion on Ground	Elevated on support points	Elevated but sagging slightly	Sagging near ground, or broken	All of log on ground, sinking	All of log on ground, partly sunken
Twigs < 3 cm (if originally present)	Present	Absent	Absent	Absent	Absent
Bark	Intact	Intact or partly missing	Trace	Absent	Absent
Shape	Round	Round	Round	Round to oval	Oval
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).

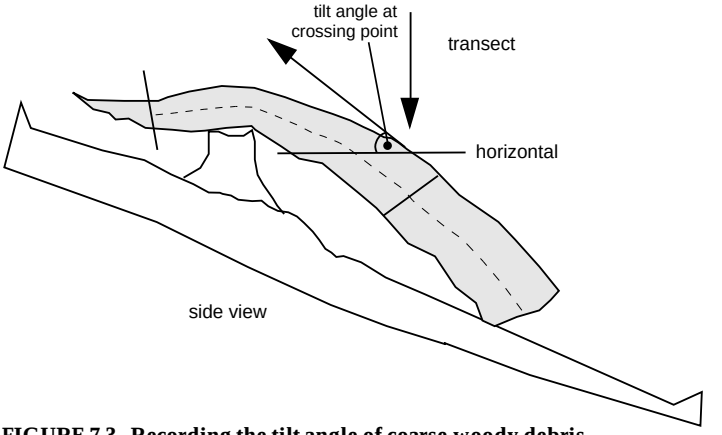


FIGURE 7.3. Recording the tilt angle of coarse woody debris.

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.

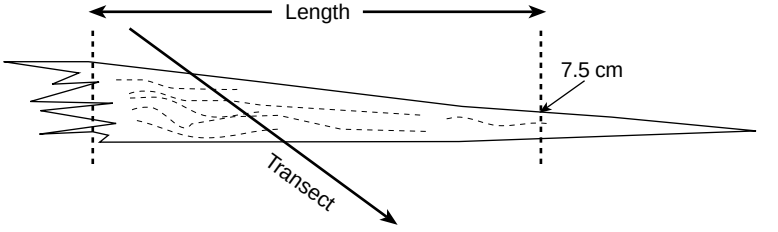


FIGURE 7.4a

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).

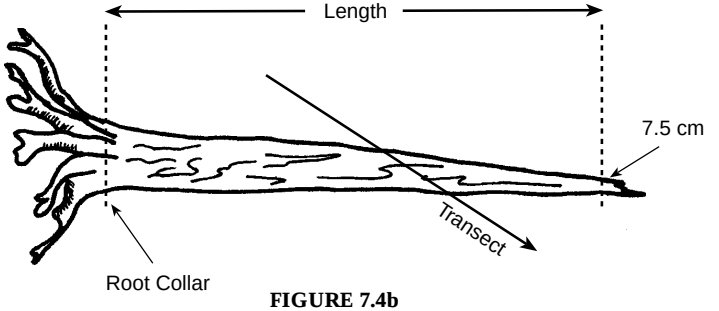


FIGURE 7.4b

- 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).

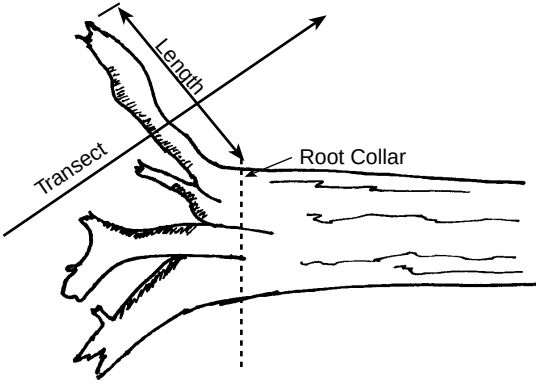


FIGURE 7.4c

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).

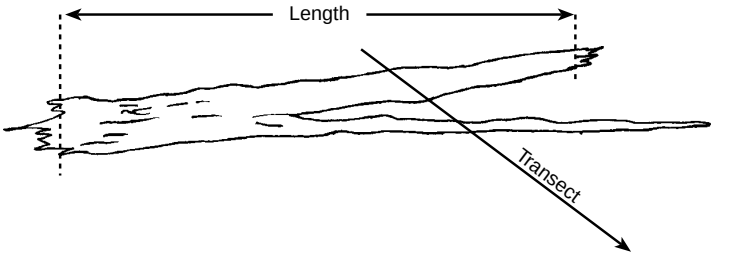


FIGURE 7.4d

- The piece length of the smaller stem(s) (smaller diameter) will be measured only to the junction with the main bole (see 7.4e).

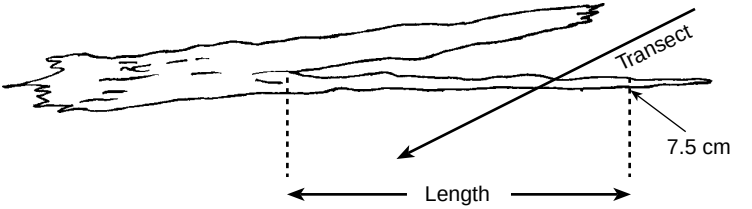


FIGURE 7.4e

- 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).

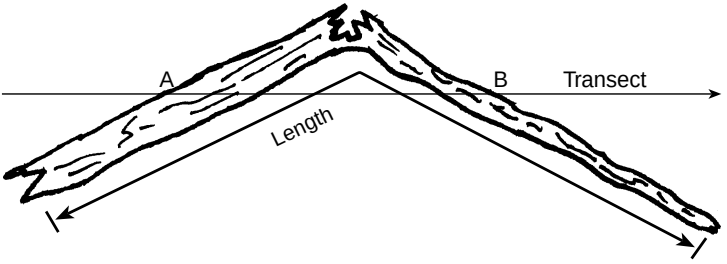


FIGURE 7.4f

- The full piece length of curved / crooked pieces is measured at both crossings (see 7.4g).

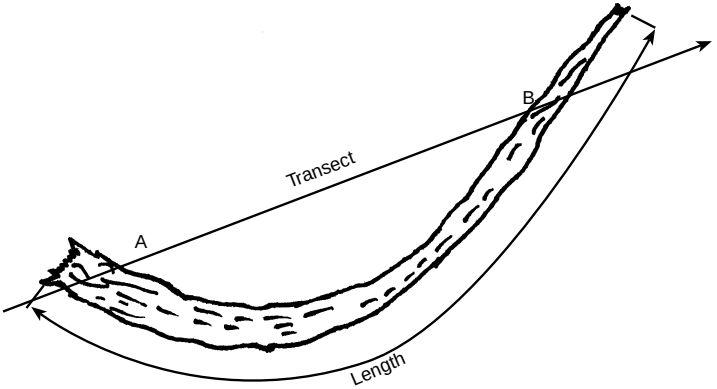


FIGURE 7.4g

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 7.5. 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

APPENDIX 7.1 Tree Species Codes[1]

Conifers

Common name	Species	Code
Cedar	*Thuja*	
western redcedar	*T. plicata*	Cw
Cypress	*Chamaecyparis*	
yellow-cedar	*C. nootkatensis*	Yc
Douglas-fir	*Pseudotsuga*	
Douglas-fir	*P. menziesii*	Fd
interior Douglas-fir	*P. menziesii* var. *glauca*	Fdi
coast Douglas-fir	*P. menziesii* var. *menziesii*	Fdc
Fir (Balsam)	*Abies*	
amabilis fir	*A. amabilis*	Ba
grand fir	*A. grandis*	Bg
subalpine fir	*A. lasiocarpa*	Bl
Hemlock	*Tsuga*	
mountain hemlock	*T. mertensiana*	Hm
western hemlock	*T. heterophylla*	Hw
mountain x western hemlock hybrid	*T. mertensiana* x *heterophylla*	Hxm
Juniper	*Juniperus*	
Rocky Mountain juniper	*J. scopulorum*	Jr
Larch	*Larix*	
alpine larch	*L. lyallii*	La
tamarack	*L. laricina*	Lt
western larch	*L. occidentalis*	Lw
Pine	*Pinus*	
whitebark pine	*P. albicaulis*	Pa
limber pine	*P. flexilis*	Pf
jack pine	*P. banksiana*	Pj
lodgepole pine	*P. contorta*	Pl
lodgepole x jack pine hybrid	*P.* x *murraybanksiana*	Pxj
shore pine	*P. contorta* var. *contorta*	Plc
lodgepole pine	*P. contorta* var. *latifolia*	Pli
western white pine	*P. monticola*	Pw
ponderosa pine	*P. ponderosa*	Py
Spruce	*Picea*	
black spruce	*P. mariana*	Sb
Engelmann spruce	*P. engelmannii*	Se
white spruce	*P. glauca*	Sw
Sitka spruce	*P. sitchensis*	Ss
spruce hybrid	*Picea* cross	Sx
Engelmann x white	*P. engelmannii* x *glauca*	Sxw

Conifers (continued)

Common name	Species	Code
Sitka x white	*P.* x *lutzii*	Sxl
Sitka x unknown	*P. sitchensis* x *?*	Sxs
Yew	*Taxus*	
western yew	*T. brevifolia*	Tw

Hardwoods

Common name	Species	Code
Alder	*Alnus*	
red alder	*A. rubra*	Dr
Apple	*Malus*	
Pacific crab apple	*Malus fusca*	Up
Aspen, Cottonwood, Poplar	*Populus*	
poplar	*P. balsamifera*	Ac
balsam poplar	*P. b.* ssp. *balsamifera*	Acb
cottonwood	*P. b.* ssp. *trichocarpa*	Act
hybrid poplar	*P.* spp.	Ax
trembling aspen	*P. tremuloides*	At
Arbutus	*Arbutus*	
arbutus	*A. menziesii*	Ra
Birch	*Betula*	
Alaska paper birch	*B. neoalaskana*	Ea
Alaska x paper birch hybid	*B.* x *winteri*	Exp
paper birch	*B. papyrifera*	Ep
water birch	*B. occidentalis*	Ew
Cascara	*Rhamnus*	
cascara	*R. purshiana*	Kc
Cherry	*Prunus*	
bitter cherry	*P. emarginata*	Vb
pin cherry	*P. pensylvanica*	Vp
choke cherry	*P. virginiana*	Vv
Dogwood	*Cornus*	
western flowering dogwood	*C. nuttallii*	Gp
Maple	*Acer*	
bigleaf maple	*A. macrophyllum*	Mb
vine maple	*A. circinatum*	Mv
Oak	*Quercus*	
Garry oak	*Q. garryana*	Qg

Hardwoods (continued)

Common name	Species	Code
Willow	*Salix*	
peach-leaf willow	*S. amygdaloides*	Wa
Bebb's willow	*S. bebbiana*	Wb
pussy willow	*S. discolor*	Wd
Pacific willow	*S. lucida*	Wp
Scouler's willow	*S. scouleriana*	Ws
Sitka willow	*S. sitchensis*	Wt

Others

Common name	Species	Code
Unknown		
Unknown conifer		Xc
Unknown hardwood		Xh
Other tree, not on list		
Other conifer		Zc
Other hardwood		Zh

[1]Additional codes for exotic tree species available from B.C. Ministry of Forests, Research Branch. Also noted in Appendix 4.1

8 REFERENCES

Armleder, H.M., S.K. Stevenson, and S.D. Walker. 1992. Estimating the abundance of arboreal forage lichens. B.C. Min. For., Victoria, B.C. Land Management Handbook No. 7 (Insert).

Canadian System of Soil Classification. 1998. The Canadian system of soil classification. Third edition. Soil Classification Working Group, Research Branch, Agriculture Agri-food Canada, Ottawa.

Cannings, R.A. and A.P. Harcombe. (editors). 1990. The vertebrates of British Columbia: scientific and English Names. B.C. Min. of Municipal Affairs, Recreation and Culture, and B.C. Min. Environ., Victoria, B.C. Royal British Columbia Museum Heritage Record No. 20; Wildlife Report No. R24.

Inventory Branch. 1993. Growth and yield: establishment of permanent growth samples in natural stands. B.C. Min. For., Victoria, B.C. Forest Inventory Manual.

Green, R., R.L. Trowbridge, and K. Klinka. 1993. Towards a taxonomic classification of humus forms. Supplement to Forest Science, Vol. 39, No. 1, Feb. 1993. Washington, D.C.

Hamilton, E. 1988. A system for the classification of seral ecosystems within the Biogeoclimatic Ecosystem Classification system. First approximation. B.C. Min. For. and Lands, Victoria, B.C. Research Report RR87004-HQ.

Howes, D.E. and E. Kenk. 1997. Terrain classification system for British Columbia. Version 2. B.C. Min. Env., Lands and Parks, MOE Manual 10, Victoria, B.C.

Luttmerding, H.A., D.A. Demarchi, E.C. Lea, D.V. Meidinger, and T. Vold. (editors). 1990. Describing ecosystems in the field. Second edition. B.C. Min. Env., Lands and Parks and B.C. Min. of For., MOE Manual 11. Victoria, B.C.

Meidinger, D., T. Lee, G.W. Douglas, G. Britton, W. MacKenzie, and H. Qian. 1998. British Columbia plant species codes and selected attributes. B.C. Min. For., Victoria, B.C. Research Br. Database.

Oliver, C.D., and B.C. Larson, 1990. Forest stand dynamics. McGraw-Hill, New York, N.Y.

Resources Inventory Branch, 1997. Vegetation resources inventory: sampling procedures. B.C. Min. For., Victoria, B.C.

Resources Inventory Committee. 1998. British Columbia Wildlife Habitat Ratings Standards. Review Draft. Wildlife Interpretations Subcommittee. Victoria, B.C.

Resources Inventory Committee. 1997 (in prep). Procedures for wildlife capability and suitability mapping in British Columbia. Review Draft. Wildlife Interpretations Subcommittee. Victoria, B.C.

Resources Inventory Committee: Elements Working Group. 1996. Standardized inventory methodologies for components of British Columbia's biodiversity. Prov. of B.C., Victoria, B.C.

Resources Inventory Committee: Terrestrial Ecosystems Group. Standards for wildlife habitat capability and suitability ratings in British Columbia. Prov. of B.C., Victoria, B.C.

Resources Inventory Committee: Vegetation Inventory Working Group. 1995. The British Columbia Land Cover Classification: background and definitions, a working document. Prov. B.C., Victoria, B.C.

VENUS. 1998. VENUS 3.0: Vegetation and Environment data NexUS, data-entry, reporting and analysis tool, version 3. B.C. Min. Environ. and B.C. Min. of For., Victoria, B.C.

Weetman, G.F., E. Ponozzo, M. Jull, and K. Marek. 1990. An assessment of opportunities for alternative silvicultural systems in the SBS, ICH, and ESSF biogeoclimatic zones of the Prince Rupert Forest Region. B.C. Min. For., Smithers, B.C. Contract Report.

BRITISH COLUMBIA — GROUND INSPECTION FORM

G ☐ vs V ☐	PHOTO	X:	Y:	DATE
PROJECT ID.		SURV.		
MAP SHEET		PLOT #		POLY. #
UTM ZONE	LAT. / NORTH	LONG. / EAST		
ASPECT °		ELEVATION		m
SLOPE %	SMR	SNR		

MESO SLOPE POSTION

☐ Crest ☐ Mid slope ☐ Depression
☐ Upper slope ☐ Lower slope ☐ Level
☐ Toe

DRAINAGE - MINERAL SOILS

☐ Very rapidly ☐ Well ☐ Poorly
☐ Rapidly ☐ Mod. well ☐ Very poorly
☐ Imperfectly

MOISTURE SUBCLASSES - ORGANIC SOILS

☐ Aqueous ☐ Aquic ☐ Perhumid
☐ Peraquic ☐ Subaquic ☐ Humid

MINERAL SOIL TEXTURE

☐ Sandy (LS,S) ☐ Silty (SiL,Si)
☐ Loamy (SL,L,SCL,FSL) ☐ Clayey (SiCL,CL,SC,SiC,C)

ORGANIC SOIL TEXTURE

☐ Fibric ☐ Mesic ☐ Humic

SURF. ORGANIC HORIZON THICKNESS

☐ 0–40 cm ☐ > 40 cm

HUMUS FORM

☐ Mor ☐ Moder ☐ Mull

ROOT RESTRICTING LAYER

Depth _____ cm Type _____

COARSE FRAGMENT CONTENT

☐ < 20% ☐ 20–35% ☐ 35–70% ☐ > 70%

TERRAIN

COMPONENT: TC1 ☐ TC2 ☐ TC3 ☐

TERRAIN TEXTURE	SURFICIAL MATERIAL	SURFACE EXPRESSION	GEOMORPH PROCESS
1	1	1	1
2	2	2	2

ECOSYSTEM

COMPONENT: EC1 ☐ EC2 ☐ EC3 ☐

BGC UNIT	ECOSECTION
SITE SERIES	SITE MODIFIERS
STRUCTURAL STAGE	CROWN CLOSURE %

ECOSYSTEM POLYGON SUMMARY

	%	SS	SM	ST
EC1				
EC2				
EC3				

TERRAIN POLYGON SUMMARY

	%	Classification
TC1		
TC2		
TC3		

DOMINANT / INDICATOR PLANT SPECIES

TOTAL %	A:	B:	C:	D:

L.	SPECIES	%	L.	SPECIES	%	L.	SPECIES	%

COMPLETE ☐ PARTIAL ☐

Tree Mensuration

Spp.	DBH	Ht. Calculation to DBH						Ht. to DBH	Total HT	BH Age	Path Y/N
		Top	Bot	SD	SL	HD	HT				

NOTES (site diagram, exposure, gleying, etc.)

ECOSYSTEM FIELD FORM

BRITISH COLUMBIA

MINISTRY OF FORESTS
BC ENVIRONMENT

DATE	Y	M	D

PLOT NO.

PROJECT ID.

FIELD NO.

SURVEYOR(S)

SITE DESCRIPTION

LOCATION

GENERAL LOCATION

FOREST REGION	MAPSHEET	UTM ZONE	LAT./ NORTH.	LONG./ EAST.

AIRPHOTO NO.	X CO-ORD.	Y CO-ORD.	MAP UNIT

SITE INFORMATION

PLOT REPRESENTING

BGC UNIT	SITE SERIES	TRANS./ DISTRIB.	ECOSECTION

MOISTURE REGIME	NUTRIENT REGIME	SUCCESS. STATUS	STRUCT. STAGE	REALM/ CLASS

ELEV. m.	SLOPE %	ASPECT °	MESO SLOPE POS.	SURFACE TOPOG.

NOTES

SITE DIAGRAM

SITE DISTURB.	PHOTO ROLL

EXPOS. TYPE	FRAME NOS.

SUBSTRATE (%)

ORG. MATTER		ROCKS	
DEC. WOOD		MINERAL SOIL	
BEDROCK		WATER	

FS882 (1) HRE 98/5

FS882 (3) HRE 98/5

VEGETATION

NOTES:

TREES	A1	A2	A3	A	B1	B2	B

SHRUBS	B1	B2	B

ADDITIONAL SPECIES	LAYER	%

HERB LAYER (C)	%

MOSS / LICHEN / SEEDLING (D)	%

SPP. LIST: COMP. ☐ PART. ☐

% COVER BY LAYER: TREE (A) ☐ SHRUB (B) ☐ HERB (C) ☐ MOSS / LICHEN (D) ☐

SURVEYOR(S)

PLOT NO.

PAGE OF

SOIL DESCRIPTION

GEOLOGY	BEDROCK	C. F. LITH.	SURVEYOR(S)	PLOT NO.
TERRAIN	TEXTURE 1 / 2	SURFICIAL MATERIAL 1 / 2	SURFACE EXPR. 1 / 2	GEOMORPH. PROCESS 1 / 2
SOIL CLASS.		HUMUS FORM	HYDROGEO.	
ROOTING DEPTH cm	ROOT RESTRICT. LAYER TYPE		WATER SOURCE	DRAINAGE
R. Z. PART. SIZE	ROOT RESTRICT. LAYER DEPTH cm		SEEPAGE cm	FLOOD RG.

PROFILE DIAGRAM

ORGANIC HORIZONS/LAYERS

HOR/ LAYER	DEPTH	FABRIC STRUCTURE	FABRIC vPOST	MYCEL. AB.	FECAL AB.	ROOTS AB.	ROOTS SIZE	pH	COMMENTS (consistency, character, fauna, etc):

MINERAL HORIZONS/LAYERS

HOR/ LAYER	DEPTH	COLOUR	ASP.	TEXT.	% COARSE FRAGMENTS G	C	S	TOTAL	SHAPE	ROOTS AB.	ROOTS SIZE	STRUCTURE CLASS	STRUCTURE KIND	pH	COMMENTS (mottles, clay films, effervesc., etc):

NOTES:

FS882 (2) HRE 98/5

FS 882 (4) HRE 98/5

MENSURATION

MENSURATION FORM

SURVEYOR(S):

TREE#	SPP.	DBH	HEIGHT CALCULATIONS TOP	BOT.	SD	SL.	HD	HT.	HT. TO DBH	TOTAL HT.	BH AGE	SI	SUP.	CONK	BL. CONK	SCAR	F. ORC.	F. CRACK	MISTLE	R. BRAN.	D. OR B. TOP	DAMAGE TYPE	DAMAGE SEV.	SITE SERIES

NOTES

TREE DIAMETER TALLY

TREE #	SPP	DBH	TREE #	SPP	DBH	TREE #	SPP	DBH

BRITISH COLUMBIA

WILDLIFE HABITAT ASSESSMENT

Proj. id.		Date	y	m	d	N-hab. feature	type			page	of
Plot no.		Surveyor					dst.				

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.
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Comments / Notes

FS 882 (5) HRE 98/5

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.

Comments / Notes

Abbreviated Tree Attributes for Wildlife

B.A.F.		Area		Min DBH	
No. of trees		No. dead		No. live	
Avg. DBH (cm)			Avg. length (m)		
Avg. lich load class		Comments			

Simple Coarse Woody Debris

Sampled ____ m of 30 m transect

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

Comments

Management

Species (Sp. group)	Use	Ssn.	F/C LR(s)	Cap.	Mgmt. Tech.	M. Feat / Int	Comments / Notes

FS 882 (5) HRE 98/5

BRITISH COLUMBIA

TREE ATTRIBUTES FOR WILDLIFE

Project id.		Plot no.		Surveyor	
B.A.F (m^2/ha)		Plot size (m^2)		Minimum DBH (cm)		Date	y	m	d

Tree No.	Species	Stand/Fall	DBH (cm)	M or E	Rem. Bark (%)	Length				Estimated length (m)	Cr. Class	Height to live crown (m)	Wildlife Codes						Comments
						Top (%)	Bot (%)	Bot pos (m)	Slope Distance (m)				Appear	Crown	Bark	Wood	Lichen	Wildlife use	
01			.					.	.										
02			.					.	.										
03			.					.	.										
04			.					.	.										
05			.					.	.										
06			.					.	.										
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18			.					.	.										
19			.					.	.										
20			.					.	.										

FS 882 (6) HRE 98/5

BRITISH COLUMBIA

Date y m d

COARSE WOODY DEBRIS

Project id. | Plot no. | Surveyor

Tree No.	Transect #1 Azimuth (0–359) Sampled of 24 m: Species	Diameter (cm)	Class	Tilt Angle	Length (m)	Height of end (cm)	Angle grnd.	Transect #2 Azimuth (0–359) Sampled of 24 m: Species	Diameter (cm)	Class	Tilt Angle	Length (m)	Height of end (cm)	Angle grnd.
01														
02														
03														
04														
05														
06														
07														
08														
09														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														

Degree and Type of Piling (in plot boundaries)

Pile #	Size of pile (m) length	width	height	Diam (cm)	Inter. spac.
1					
2					
3					
4					
5					
6					
7					
8					

Comments