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FOREST AND RANGE EVALUATION PROGRAM

Field Guide for
**Stand-level
Biodiversity
Monitoring**

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Prepared by
Nancy Densmore
Richard Thompson
Dean McGeough
Bryce Bancroft
Victoria, BC

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This field guide is set up to provide guidance on how to collect information set out in the following field cards:

- FS 1244 – A1 HFP 2008/04.

This field protocol is meant as a companion to the office based protocol where more detail and background is provided (visit http://www.for.gov.bc.ca/hfp/frep/site_files/indicators/Indicators-SLBD-Protocol-2008.pdf).

Structure of This Field Guide

The field guide is set up with following headings and structure:

Sampling – number of plots and what to sample

Data forms – description of each form and what is required where

Sampling examples – normal situations

Note: *It is used to provide additional background information and guidance. Words or phrases in italics are done so to draw attention to significant information.*

Stand-level biodiversity monitoring is meant to capture the structural attributes that have been left within the cutblock.

This field guide will help determine how and what to sample. It is meant to be used in the field so is purposely brief. For help with plot location, see full protocol.

Sampling Approach

Pre-identify all your potential sample point locations using a grid approach and randomly choose sample points. The following section is meant as a quick check for guidance on choosing the right number of plots for the strata in a block. For help, see full protocol.

Harvested Area

- *For all blocks <100 ha (NAR) – sample 3 plots*
- *See big block appendix in full protocol for blocks ≥ 100 ha*

Note: *At each plot, collect both tree (if dispersed retention) and CWD data. There are several potential approaches to tree data collection (see Dispersed Retention Sampling).*

QUESTION: *What if I have numerous small harvest units that are non-contiguous as part of my cutblock? How do I choose which harvest units to sample?*

Answer: Sample as one harvest area, choose three plots at random from the total cutblock opening population. If possible, look at each harvest unit to ensure you are not missing something (e.g., retention that wasn't mapped (or look at aerial photos)). Take good notes.

Retention Patches

- For each patch (do not lump non-contiguous patches) sample *one plot per ha*.
- *Maximum of 5 plots per patch.*

Note: If there is no patch retention only sample the harvest area as described above.

Stratification

The plot type for collecting tree data (e.g., prism size, fixed radius or full count) must not change within a single stratum. Therefore, it is important to first understand what constitutes a stratum. Here are a few points to keep in mind when considering the retention on a cutblock:

- *Patch retention internal to the harvest boundary is considered part of the cutblock.*
- *Patch retention external but contiguous, or external and non-contiguous, with the harvest boundary is considered part of the cutblock if it is acknowledged as such on the SP or post-harvest map. Don't sample it if it is not acknowledged – it may be retention related to adjacent or future cutblocks.*
- *If a retention patch is not included in the gross area indicated on the SP map, but it is part of the cutblock, the patch area needs to be added into the gross area noted on Form C, Section 11, and becomes the override area.*
- *If a road splits a retention patch, it is still considered one stratum.*

- *If the SP map shows two patches which are contiguous (e.g., a WTP immediately alongside a RRZ), consider these as one stratum (a single patch) and sample accordingly.*
- All separate (non-contiguous) patches should be sampled separately as different strata. They must each have a unique stratum ID and have a Form B (or section 16) filled in for the stratum.
- You may stratify a harvest area to allow for the most efficient tree data collection methodology – remember you must fill in a Form B for each stratum. Stratification of harvest area is useful to capture differing retention strategies (clearcut, very low density dispersed retention, high density dispersed retention). Do not automatically stratify harvest areas by Standards Units.

QUESTION: *How do we approach sampling in several harvest strata with different levels of dispersed retention?*

Answer: Stratification of dispersed retention areas is done to get appropriate plot sizes for efficient tree counts. It is not intended to force 3 plots within each dispersed stratum. The same “rule of thumb” for plot numbers in the harvest area applies regardless of the number of stratum in harvest/dispersed areas (i.e., 3 plots in the harvest area, increasing for large cutblocks). However, a large stratum with a high density of dispersed retention may warrant an additional plot to better estimate standing tree indicators.

General Field Procedures

Before conducting field measurements, do a brief block overview (e.g., from road vantage or during flight approach) to plan your strategy and confirm stratification.

Review each retention patch upon approach to capture the dominant tree height (for calibration), ecological anchors, tree species composition, windthrow patterns and other noteworthy features. This process will assist you in completing the Stratum summary (FS 1244-B1). Once all plots are completed for the stratum, complete the stratum summary – you may need to do a partial walk through to explore portions not seen during the plot work.

Sample Point Data Collection

General Procedures

- Flag the plot centres – Record RSM plot # and date on the flagging tape.
- **For tree data** – Measure at least one height and diameter per plot to calibrate estimates.
- **For CWD data** – Measure one length and diameter per 30-m CWD line transect.
- Record estimates without a decimal. Record measured trees and CWD to one decimal place.
- Use only one measurement type and plot size (i.e., prism, fixed area, or full count) per stratum (see section on stratification).
- Should be within 10% of actual size (dbh and height, or length for CWD). Occasionally check your estimates to ensure they meet the accuracy target.

Tree Data – Retention Patches or Dispersed Retention

Prism Plots – *retention patches or harvest sample points with dense dispersed retention.*

- Target is average of 6–10 Layer 1 trees (≥ 12.5 cm dbh) in a stratum's plots. Use this target number of trees to select your BAF.
- Paint or mark the first tree measured and sweep your prism clockwise.
- Use the same BAF within a stratum (individual patch).

Borderline trees (for determining if borderline BAF trees are in/out of plot):

Measure borderline trees to determine if they are IN or OUT. The formula is: $LD = PRF \times DBH$.

Table 1. Table showing plot radius factors $PRF = \frac{1}{2\sqrt{BAF}}$

BAF	PRF	BAF	PRF
1	.500	11	.151
2	.354	12	.144
3	.289	13	.139
4	.250	14	.134
5	.224	15	.129
6	.204	16	.125
7	.189		
8	.177	18	.118
9	.167		
10	.158	20	.112

Prism plots on the stratum edge

Where a plot is within the fringe of a stratum, move the plot centre into the stratum. First, determine if the plot is an edge plot by calculating the plot's limiting distance (LD) based on the largest tree in your prism sweep and the plot radius factor (see Table 1).

For example: a 30 cm DBH tree with a BAF 4 prism (plot radius factor of 0.25). $LD = 7.5 \text{ m } (0.25 \times 30)$. If the distance to the pith of the tree is $>7.5 \text{ m}$ (at 1.3 m DBH), it is out.

If full prism plot cannot fit in narrow stratum

If a very narrow stratum, such as a riparian reserve zone, does not allow for a complete prism plot, even if moved to the centre of the stratum, establish a half-plot. Split through the plot centre parallel to the type line. The trees inside the half-plot sample area are recorded twice (make a comment that this plot was a border plot and enter each tree twice).

Fixed-area Plots – *harvest sample points with low levels of dispersed retention, or very open unlogged retention patches (mostly non-merch or non-commercial cover).*

- Use the same plot radius for all plots within a given stratum (either in the harvest area or an open reserve patch).
- Try for an average of 6–20 trees per plot, realizing that zero plots can happen. Generally observe the whole stratum to help choose the plot radius. You may need to stratify the stratum to allow for different plot sizes. This can be done with aerial photos or in the field from selected vantage points. **REMEMBER**, each time you switch plot types, you must designate the dispersed stratum area it applies to by filling out a Form B. In this way, the appropriate weighting can be applied during data analysis.
- A 30-m radius is recommended as a starting point. Adjust this radius up or down in 5-m increments (maximum of 50 m).
- Paint or mark the first tree measured and sweep your fixed-area plot in a clockwise fashion.
- If a plot lands on the border of the stratum, move the plot so that it is fully within the stratum (relocate the plot centre in a perpendicular direction from the stratum edge so that the plot centre is 1 plot radius distance from the edge).

Full Count Area – *stratum with scattered trees (generally < 30 trees in stratum)*

Entire area of stratum: The stratum area will typically be the full area of NAR, or one or more SUs which make up the stratum. If more than 20 or 30 trees are likely to be counted, consider another method.

Subset of stratum area: You may do a full count of a representative subset of the total stratum area. Choose an easily recognizable area where you can obtain a full count of all trees and determine the area. Only one full count area is allowed per stratum. Whenever the full count area is smaller than the total stratum area, the data will be extrapolated to the full stratum.

If possible, put all the full count tree data on the stand table of the first plot (Form A) in that stratum.

QUESTION: *What about stumps and stubs?*

Answer: Only tally trees (which may be cut or broken) that are taller than 1.3 m (breast height) and with a DBH of 12.5 cm or greater.

Do not tally high stumps or stumps from first pass logging even if they are over 1.3 metres.

Tally stubs (purposely made at the time of harvest) found in prism or fixed-area plots – do not do a full count of stubs.

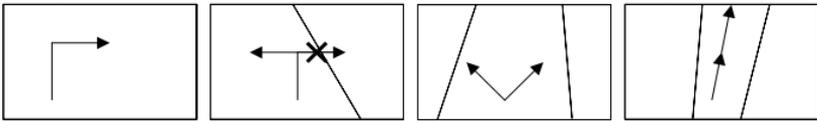
CWD Line Transects – Both Retention Patches and Harvest Area

One 30-m transect with a 90° bend is established from plot centre using a measuring tape. All woody pieces with a diameter >7.5 cm at the point where their central axis is intersected by the tape are tallied.

Establishing transects

- A CWD line transect is established from each plot centre.
- Establish the first 15-m leg and record the bearing. Then add 90° to your azimuth and establish the second 15-m leg.
- *Direction of first leg (to avoid bias):* First choice is to continue the bearing from last plot, point of commencement, or way point. If the transect extends out of the stratum, add 90°. If that still takes you outside the stratum, go to options 3 or 4 shown in the Figure 1.
- *The second leg is at a 90° angle additive* from the first bearing, as long as that keeps you within the same stratum. If not subtract 90°. The purpose of the 90° angle is to avoid bias in sampling CWD which may be oriented in one direction due to yarding or windthrow.
- Paint the CWD pieces at the point where they are crossed by your transect, or flag the end of each of the two 15-m transects.

KEY: If the transect extends outside of a stratum reposition as guided by Figure 1. Record your results on the field card including how you established the anomalies.



1. Normal CWD line transect – continue direction from previous plot or initial WP then turn 90°.
2. Turn transect opposite direction to remain in stratum.
3. Establish both legs from plot centre if necessary to fit in stratum.
4. In a very narrow stratum, establish both legs in line.

Figure 1. Locate CWD transect within the stratum.

Data Collected

CWD data collected is species, diameter, length, and decay class.

Note: Only diameter is used in the line transect equation to calculate volume. Length is collected as a qualitative indicator for CWD. Knowing the species and decay class of the wood helps in an assessment of diversity of CWD, and overall decay rates.

Data Card Help

Logic for Use of Section 16:

When is it acceptable to not sample a patch?

Where access is an issue (e.g., long or difficult access), a level of professional judgement needs to be made regarding the number and choice of strata sampled versus the time and cost of returning for a second field day. Rank the retention present on a block for sampling priority. Riparian and larger WTPs are higher priority. Temporary patches or a multitude of small homogenous patches are lower priority.

Note: Confirm the existence and approximate size of each patch. OK to not sample a patch when it appears homogeneous with what you've already seen, and time is a critical factor. A stratum summary is done for each stratum regardless of whether they are sampled. The main purpose of Section 16 is to reduce the number of stratum summary pages (Form B) for strata that don't have plots. The ecological anchors

listed in Section 16 are limited to those that you might see when observing the patch from a distance (i.e., those that could stand out from the canopy). It's your choice to use Form B (and note "zero" plots in stratum) or Section 16 of Form C.

Do not use Section 16 for dispersed strata.

A Few Points to Remember When Filling in the Forms

1 Plot Identification Form A

Page X of Y – this is used to tally multiple pages used to record data for a single plot (e.g., plot 2 has 3 pages worth of field data; number them as pages 1, 2, 3 of 3).

Opening ID – numeric identification from the RESULTS database.

Stratum ID – unique ID code (maximum of 5 digits – zero to three letters followed by zero to two numbers, with no spaces). Examples are WTP1, RMZ2, VR1, NAR.

2 Plot Information (trees)

Trees exist – tick "YES" or "NO".

Fill in one of:

BAF – record basal area factor.

Fixed area radius – record radius in metres (15–50 m, recommended 30 m).

Full count – record area (ha) to which full count applies (note if the full count area is smaller than stratum area, the data will be extrapolated to the entire stratum area). Only one full count area allowed per stratum.

4 Plot Information (CWD)

Transfer Stratum ID and Plot # from front of card, in case cards are photocopied and dropped.

CWD in transect – tick "YES" or "NO"; if CWD found, record in table provided.

1st and 2nd (15 m) Leg – record azimuth of the transect. This is to help relocate transect for mentoring or auditing.

Decay Class – record CWD decay class using codes on Reference Form – Side 1 (FS 1244-D1) for CWD classes 1-4 (we do NOT use class 5).

5 Stratum Summary

Note that only Sections 1 to 5 are filled out for a clearcut (CC) stratum.

7 Reserve Constraints and Ecological Anchors

Reserve constraints – consider if the area would be part of the productive land base if it was not a reserve. Record the % of the reserve that is affected by the identified constraint(s). The “total constrained” entry is the total proportion of the stratum that is constrained, NOT the sum of all constraints.

CWD Measurement Procedures and Considerations

Field procedures for measuring CWD were adapted from the CWD field procedures, as found at <http://ilmbwww.gov.bc.ca/risc/pubs/teecolo/fmdte/cwd.htm#coarse>. Excerpts are included here to clarify and guide protocol fieldwork.

CWD Defined

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, and therefore are NOT considered CWD.

Pieces of CWD may be suspended on nearby live or dead trees, other pieces of CWD, stumps, or other terrain features. There is NO minimum length for CWD.

Coarse woody debris includes:

- downed horizontal or suspended (not self-supporting) dead tree boles with or without roots attached
- fallen trees with green foliage if roots no longer attached (no living cambium)
- 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
- recently cut logs.

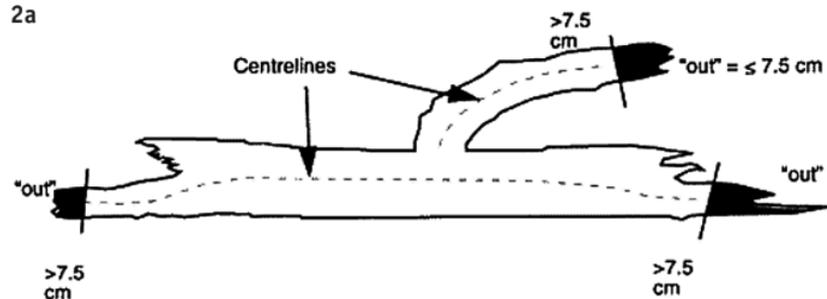
Coarse woody debris does not include:

- dead branches still connected to standing trees
- self-supporting (not overturned) stumps
- exposed roots of self-supporting trees or stumps
- material buried beneath organic or mineral soil layers, or decomposed to be considered forest floor
- live or dead trees (still rooted) which are self-supporting.

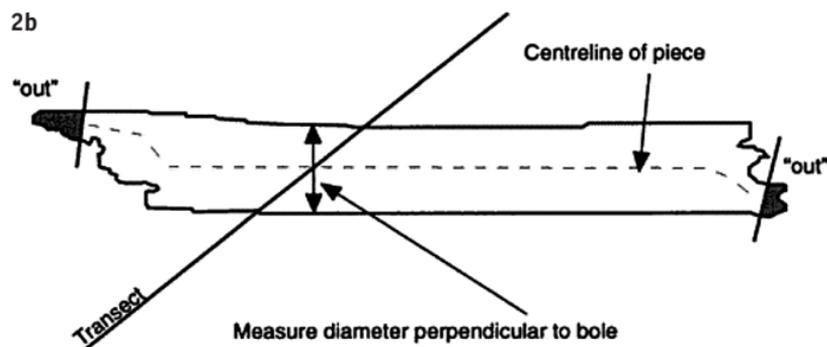
Rules for Sampling Coarse Woody Debris

- CWD is >7.5 cm in diameter (or equivalent) at the line intersect point (see Figure 2a). There is NO minimum length.
- The transect must cross the central axis of the piece (see 2b).
- If the transect coincides closely with the centreline, make your best judgement decision.
- If the transect intersects a curved or angular piece more than once, each intersection is a separate measurement (see 2d).
- 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.
- Slabs are tallied by averaging the depth and width at the point of transect intersection; if the average is >7.5 cm the piece is counted as CWD
- Tally only the CWD that lies above the soil (see Figure 3). 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.

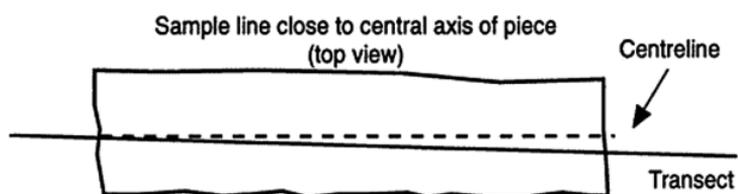
2a



2b



2c



2d

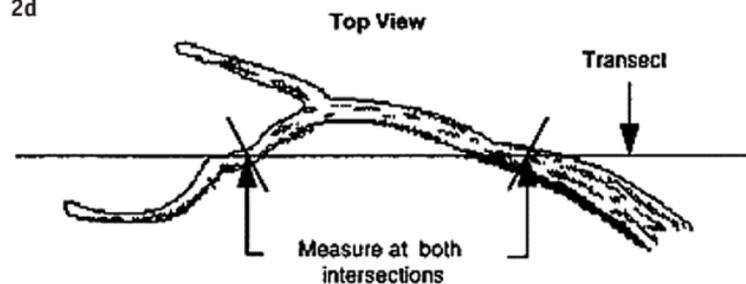


Figure 2. Rules for sampling CWD.

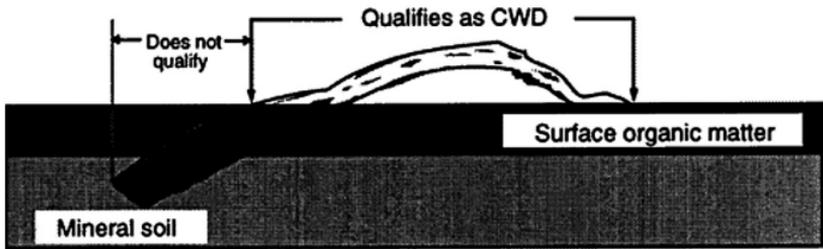


Figure 3. Tally only CWD that lies above the soil.

CWD Length

Record the measured length of each piece to the nearest 0.1 m (see Figure 4), estimated lengths to the nearest 1.0 m.

- 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.

Measurement of stems from attached roots

- For main boles with exposed roots, piece length is measured only down to the root collar (see 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 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 4d).
- The piece length of the smaller stem(s) (smaller diameter) will be measured only to the junction with the main bole (see 4e).
- For forks of near equal stature, make a determination as above and measure accordingly.

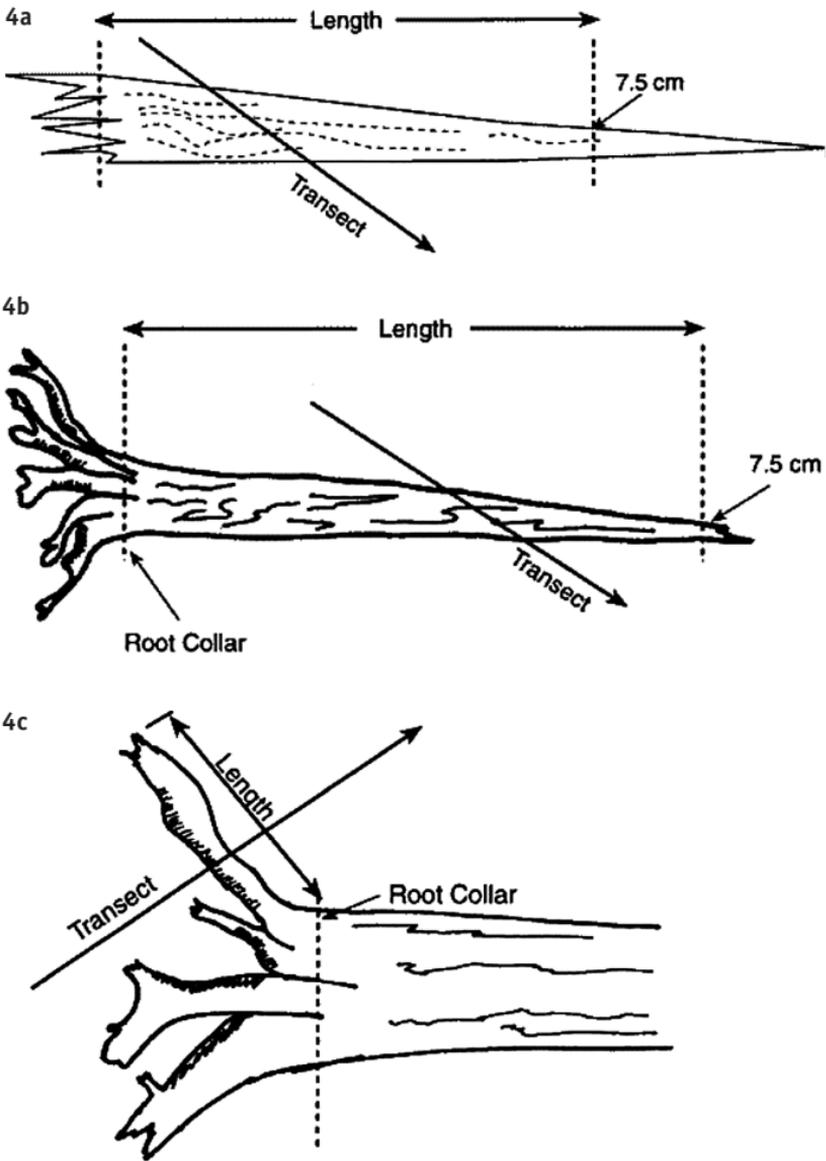


Figure 4. Rules for measuring length of CWD.

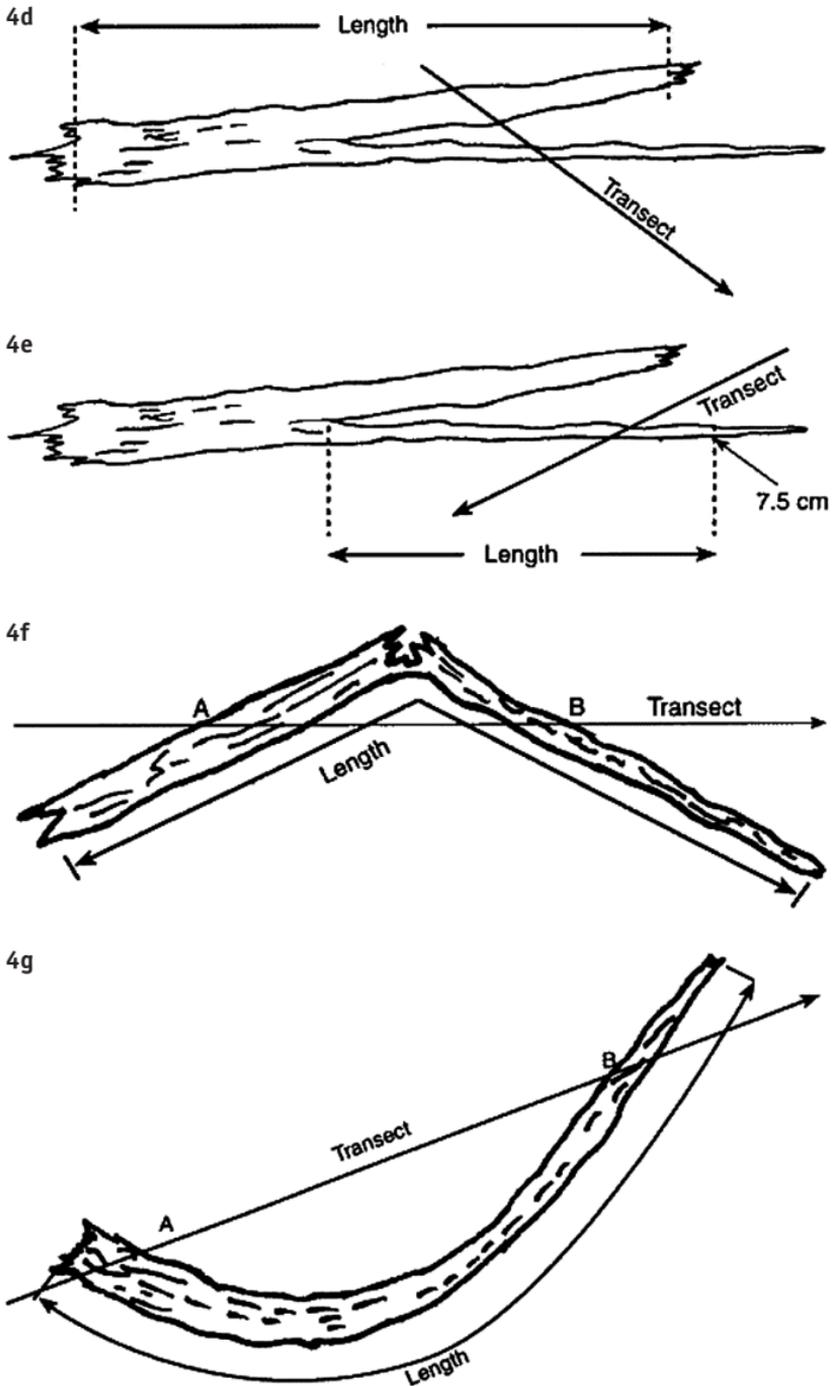


Figure 4. Rules for measuring length of CWD (cont.).

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 4f).
- The full piece length of curved/crooked pieces is measured at both crossings (see 4g).
- 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.