

Section 14. Down Woody Materials

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14.0 INTRODUCTION

Down woody materials (DWM) are an important component of forest ecosystems across the country. DWM is dead material on the ground in various stages of decay. Wildlife biologists, ecologists, mycologists, foresters, and fuels specialists are some of the people interested in DWM because it helps describe the:

- Quality and status of wildlife habitats.
- Structural diversity within a forest.
- Fuel loading and fire behavior.
- Carbon sequestration – the amount of carbon tied up in dead wood.
- Storage and cycling of nutrients and water – important for site productivity.

Down woody components and fuels estimated by the FIA program are: coarse woody, fine woody, litter, herb/shrubs, slash, duff, and fuelbed depth. Any crew member can learn to collect down woody materials data. If untrained members of the crew are available to help, they can locate, measure, and flag transect lines and record the condition class information for the transect segments.

DWM is only sampled in accessible forest conditions intersected by the transect. If a transect crosses a nonforest condition, the boundaries of the condition are recorded (see section 14.3) but no DWM or fuels measurements are taken along this portion of the transect. The majority of DWM in the inventory is sampled using the line intersect sampling method (also called planar intercept method). In this method, transects are established, and individual pieces of CWD or FWD are tallied if the central axis of the piece is intersected by the plane of the transect. In addition, each piece must meet specified dimensions and other criteria before being selected for tally. Special procedures apply when a CWD piece lays across a condition class boundary (section 14.2). Transects will always be used to sample FWD. Transects will be used to sample CWD when crews are able to see and measure individual pieces.

The line intersect method is not practical for sampling CWD when it is part of machine-piled windrows or slash piles, or part of log "jumbles" at the bottom of steep-sided ravines. In these situations, individual pieces are impractical to tally separately and are labeled as "residue piles". A different sampling method is used to tally and measure CWD residue piles (see section 14.8, Sampling Residue Piles).

Note: This indicator is CORE OPTIONAL on all phase 2 plots.

14.1 DEFINITION OF DOWN WOODY MATERIALS

CWD – In this inventory, CWD includes downed, dead tree and shrub boles, large limbs, and other woody pieces that are severed from their original source of growth and on the ground. CWD also includes dead trees (either self-supported by roots, severed from roots, or uprooted) that are leaning > 45 degrees from vertical. Also included are non-machine processed round wood such as fence posts and cabin logs. For multi-stemmed woodland trees such as juniper, only tally stems that are dead, detached, and on the ground; or dead and leaning > 45 degrees from vertical.

CWD does not include:

1. Woody pieces < 3.0 inches in diameter at the point of intersection with the transect.
2. Dead trees leaning 0 to 45 degrees from vertical.
3. Dead shrubs, self-supported by their roots.
4. Trees showing any sign of life.
5. Stumps that are rooted in the ground (i.e., not uprooted).
6. Dead foliage, bark or other non-woody pieces that are not an integral part of a bole or limb. (Bark attached to a portion of a piece is an integral part).
7. Roots or main bole below the root collar.

FWD – In this inventory, FWD includes downed, dead branches, twigs, and small tree or shrub boles that are not attached to a living or standing dead source. FWD can be connected to a larger branch, as long as this branch is on the ground and not connected to a standing dead or live tree. Only the woody branches, twigs, and fragments that intersect the transect are counted. FWD can be connected to a down, dead tree bole or down, dead shrub. FWD can be twigs from shrubs and vines. FWD must be no higher than 6 feet above the ground to be counted.

FWD does not include:

- 1) Woody pieces ≥ 3.0 inches in diameter at the point of intersection with the transect.
- 2) Dead branches connected to a live tree or shrub; or to a standing dead tree or dead shrub.
- 3) Dead foliage (i.e., pine or fir needles, or leaf petioles).
- 4) Bark fragments or other non-woody pieces that are not an integral part of a branch, twig, or small bole.
- 5) Small pieces of decomposed wood (i.e., chunks of cubical rot)

14.2 LOCATING AND ESTABLISHING LINE TRANSECTS

Transects are established on each subplot if the subplot center is accessible (i.e., not census water, access denied, or hazardous), and there is at least one forest land condition class mapped within the 24.0-foot radius subplot (CONDITION CLASS STATUS = 1). Transects begin at the subplot center and extend 24.0 feet to the edge of the subplot. The location of condition class boundaries are recorded along the transect. It is extremely important to lay out the transect in a straight line to avoid biasing the selection of pieces and to allow the remeasurement of transect lines and tally pieces for future change detection.

Transect lines should be marked with a pin or small piece of flagging at the end of the line (24.0 feet, horizontal distance) to help the QA staff identify the path of the transect during the check-plot procedure. Because the tolerance for the transect azimuth is ± 2 degrees, the line might have been laid down in a slightly different direction from the check-plot crew. This could affect the location of diameter measurements for CWD pieces as well as identifying whether a CWD piece is a valid tally piece. It is also helpful to mark the point where the FWD transect begins (14 feet, slope distance).

14.2.1 CWD transects

Three transects are established that originate at the subplot center and extend out 24.0 feet horizontal distance (the radius of the subplot) at azimuths of 30, 150, 270 degrees (Figure 14-1). This transect configuration was chosen to avoid sampling bias on sloped land, where it is possible that CWD may be oriented in one direction. This configuration of transects should pick up CWD logs that are lying parallel to the slope, perpendicular to the slope, and across slope.

14.2.2 FWD transects

One transect is established on each subplot, along the 150 degree azimuth. FWD is tallied within 3 size classes. Because FWD is generally present in higher densities, a shorter transect will pick up an acceptable amount of tally. The transect begins at 14 feet (slope distance) from the subplot center and extends out either 6 or 10 feet (slope distance) depending on the FWD size class, as follows:

Category of FWD	Size Class	Diameter range	Transect length (slope distance)	Transect location (slope distance)
Small FWD	1	0 in to 0.24 in	6 feet	14 to 20 feet
Medium FWD	2	0.25 in to 0.9 in	6 feet	14 to 20 feet
Large FWD	3	1.0 in to 2.9 in	10 feet	14 to 24 feet

Note that the FWD transects are slope distance not horizontal distance. The formulas used to estimate biomass from the data contain an adjustment for slope. It is helpful to have a size gauge available until your eye is 'trained' to recognize the 3 size classes. Examples include a plastic or cardboard card with 3 notches cut for each size class, or a set of 3 dowels representing each size class.

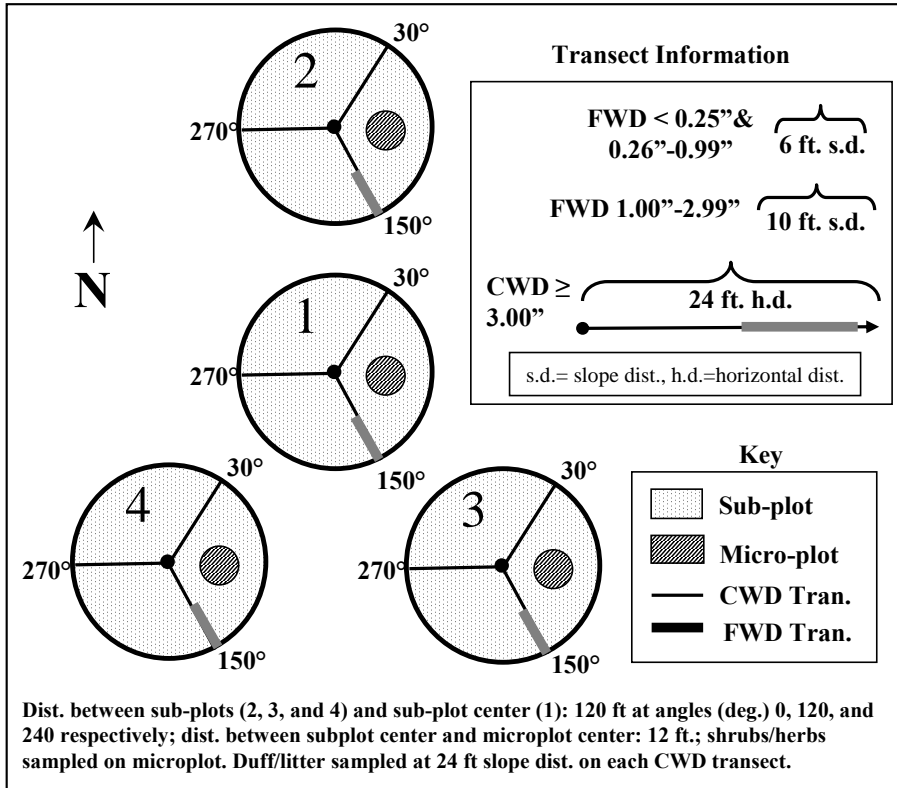


Figure 14-1. Plot layout for sampling CWD, FWD, and fuels.

14.3 TRANSECT LINE SEGMENTING

Transect lines are segmented to determine the length of transect that occurs within each mapped condition class intersecting the line. A segment is a length of transect that is in one condition. Segments are identified by recording the BEGINNING DISTANCE and ENDING DISTANCE of the slope from subplot center out to the end of the subplot. In the office, the segmenting data will be combined with CWD distances to determine which condition class each piece falls in (condition classes are not assigned to CWD pieces in the field). If more than one condition is found on the FWD transects, the segmenting information recorded here will provide the length of transect in each condition.

Starting at the subplot center and working towards the fixed radius plot boundary, each segment of transect line in a different condition class is delineated and recorded as a separate record. On each record, the BEGINNING DISTANCE and ENDING DISTANCE of the slope are recorded for each condition class encountered. The first record for each transect will have a BEGINNING DISTANCE of 0 feet. If only one condition class occurs on the transect line, only one segment is recorded. The transect must extend a total of 24.0 feet horizontal distance. If the entire 24.0-foot subplot is nonforest, enter codes for SUBPLOT NUMBER, TRANSECT, CONDITION CLASS NUMBER, followed by zeros in the remaining fields.

On subplots where a transect intersects a boundary between condition classes, the transect continues across the boundary into the adjacent class (Figure 14-2). Although DWM is only sampled in accessible

forest conditions, all CONDITION CLASS BOUNDARIES (BEGINNING DISTANCE and ENDING DISTANCE) are recorded on each transect.

Individual pieces of DWM intersected by a transect are tallied or counted if they meet the tally rules for CWD or FWD specified in the sections that follow. It is expected that the majority of FWD transects will be in one condition, but if the condition class changes along the transect, a count is recorded for each condition. Again, the segmenting data recorded here will identify which condition class is associated with each count.

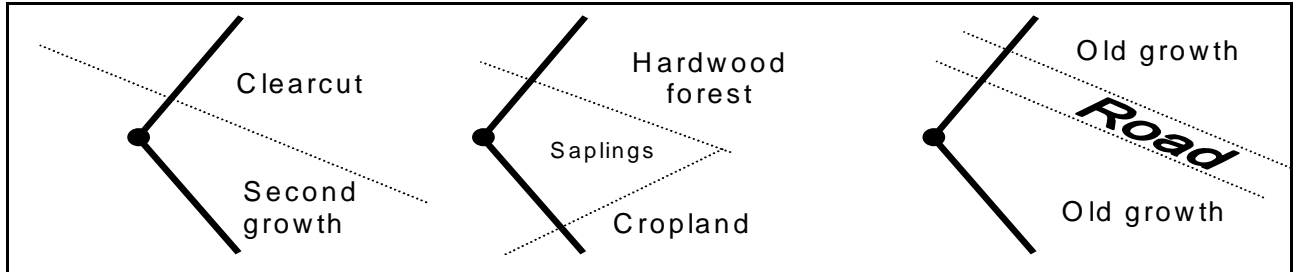


Figure 14-2. Transects are installed across condition class boundaries.

14.3.1 SUBPLOT NUMBER

Record the code indicating the subplot center from which the transect originates.

When collected: All tally segments
 Field width: 1 digit
 Tolerance: No errors
 MQO: At least 99% of the time
 Values: 1 to 4

- 1 Center subplot
- 2 North subplot
- 3 Southeast subplot
- 4 Southwest subplot

14.3.2 TRANSECT

Record the code indicating the transect on which a condition class is being delineated. The three transects used are 30 degrees, 150 degrees, and 270 degrees. These transects, when being installed, have a tolerance of +/- 2 degrees.

When Collected: All tally segments
 Field width: 3 digits
 Tolerance: No errors
 MQO: At least 99% of the time
 Values:

- 030 Transect extends 30 degrees from subplot center
- 150 Transect extends 150 degrees from subplot center
- 270 Transect extends 270 degrees from subplot center

14.3.3 CONDITION CLASS NUMBER

Record the code indicating the number of the condition class for the transect segment. Use the same code assigned to the condition class on the subplot or elsewhere on the plot. The first segment recorded for each transect will have the same CONDITION CLASS NUMBER as assigned to the subplot center.

When collected: All tally segments
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

14.3.4 BEGINNING DISTANCE

Record the location (using slope distance) on the transect line where the transect intersects the boundary with the adjacent condition class nearer to the subplot center. The first record for each transect will have a BEGINNING DISTANCE of 00.0 ft. Each subsequent record will have a BEGINNING DISTANCE equal to the ENDING DISTANCE of the previous record. Measure to the nearest 0.1 ft.

When collected: All tally segments
Field width: 3 digits
Tolerance: +/- 1.0 ft
MQO: At least 95% of the time
Values: 00.0 to 99.9

14.3.5 SLOPE PERCENT

Record the code indicating the average slope percent along the transect within the condition class being segmented. When only one condition class is present on a transect, slope percent is the average slope percent along the entire transect. Measure to the nearest 5%.

When collected: All tally segments
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 005 to 155

14.3.6 ENDING DISTANCE

Record the location (using slope distance) on the transect line where the transect exits the condition class being delineated and intersects the boundary with a different condition class further away from the subplot center. If no other condition classes are encountered, record the location (using slope distance) of the end of the transect line. Measure to the nearest 0.1 foot.

When collected: All tally segments
Field width: 3 digits
Tolerance: +/- 1.0 ft
MQO: At least 95% of the time
Values: 00.1 to 99.9

14.4 SAMPLING METHODS FOR COARSE WOODY DEBRIS (CWD)

14.4.1 Tally Rules for Coarse Woody Debris (CWD)

1. Coarse woody debris (CWD) is sampled in accessible forest land conditions only. Tally a piece if its central longitudinal axis intersects the transect, and the condition class is accessible forest land at the point of intersection (Figure 14-3). The entire piece is assigned to this condition.

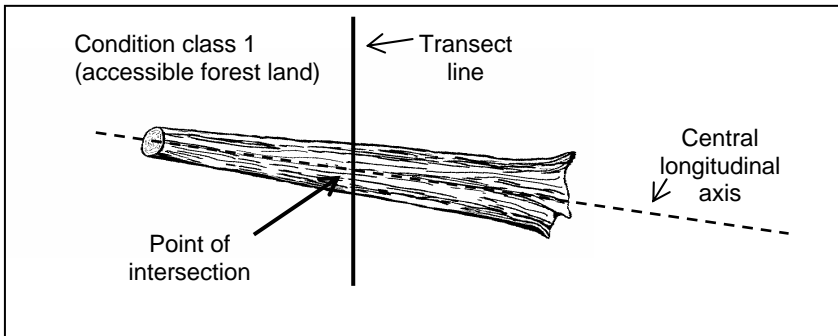


Figure 14-3. Tally rules for CWD.

2. Tally dead trees and tall stumps that are leaning > 45 degrees from vertical. Do not tally live trees or standing dead trees and stumps that are still upright and leaning < 45 degrees from vertical. Follow the same rules for down trees as outlined in section 5.0 'Tree and Sapling Data' from the P2 field guide. Most CWD will be laying on the ground.
3. The minimum length of any tally piece is 3.0 feet. When CWD pieces are close to 3 feet total length measure the length to the nearest 0.1 foot to determine if it is ≥ 3.0 feet. CWD TOTAL LENGTH (14.4.3.7) is the length of the piece that lies between the piece's recorded DIAMETER AT THE SMALL END and DIAMETER AT THE LARGE END (14.4.3.6.2 & 14.4.3.6.3),
4. Decay class of the piece determines whether or not the piece is tallied (see section 14.4.3.4).

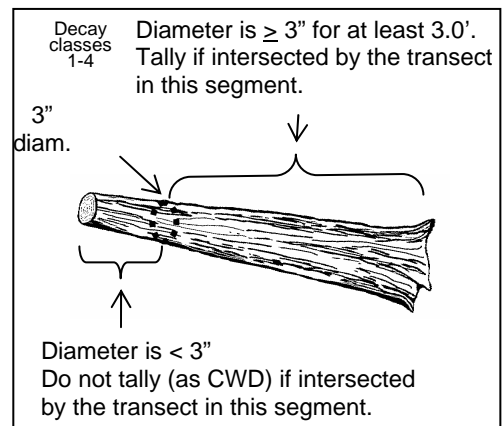


Figure 14-4. CWD tally rules for decay classes 1-4.

For decay classes 1 to 4: tally a piece if it is ≥ 3.0 inches in diameter at the point of intersection with the transect. The piece must be ≥ 3.0 feet in length and ≥ 3.0 inches or more in diameter along that length. If the intersect diameter is close to 3.0 inches, measure the diameter to the nearest 0.1 inch to determine if the piece qualifies (Figure 14-4).

For decay class 5: tally a piece if it is ≥ 5.0 inches in diameter at the point of intersection and ≥ 5.0 inches high from the ground. The piece must be ≥ 3.0 feet in length and ≥ 5.0 inches or more in diameter along that length. The reason for treating decay class 5 pieces differently is because they are difficult to identify, especially when heavily decomposed. Only pieces that still have some shape and log form are tallied—humps of decomposed wood that are becoming part of the duff layer are not tallied.

5. Tally pieces created by natural causes (examples: natural breakage or uprooting) or by human activities such as cutting only if not systematically machine-piled. Do not record pieces that are part of machine-piled slash piles or windrows, or that are part of a log "jumble" at the bottom of a steep-sided ravine in which individual pieces are impractical to tally separately. Instead, sample these piles according to instructions in section 14.8 'Sampling Residue Piles'. A slash pile or windrow consists of broken logs, limbs, and other vegetative debris.
6. Tally a piece only if the point of intersection occurs above the ground. If one end of a piece is buried in the litter, duff, or mineral soil, the piece ends at the point where it is no longer visible. Measure the diameter and length at this point.
7. If the central longitudinal axis of a piece is intersected more than once on a transect line or if it is intersected by two transect lines, tally the piece each time it is intersected (uncommon situation, see Figure 14-5).

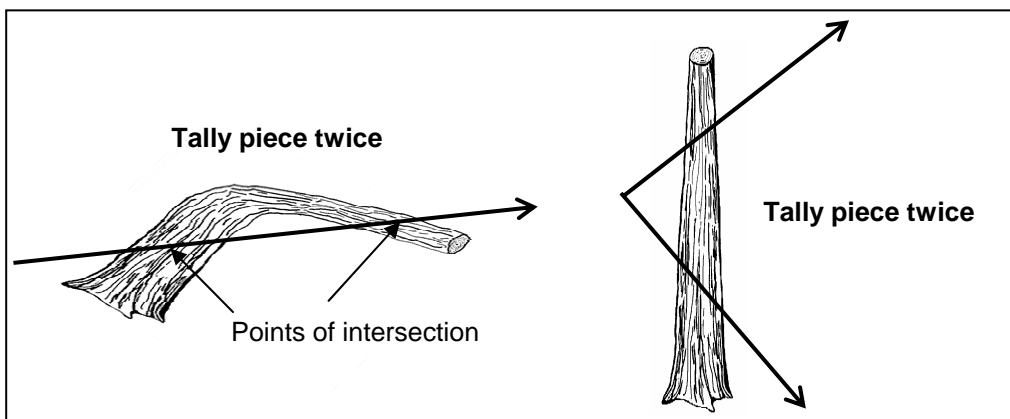


Figure 14-5. CWD tally rules: intersections.

8. Tally a piece only once if the subplot center falls directly on the central longitudinal axis of the piece. Tally the piece on the 30 degree transect and record the CWD Distance as 001.
9. If a piece is fractured across its diameter or length, and would pull apart at the fracture if pulled from either end or sides, treat it as two separate pieces. If judged that it would not pull apart, tally as one piece. Tally only the piece intersected by the transect line.
10. Do not tally a piece if it intersects the transect on the root side of the root collar. Do not tally roots.
11. When the transect crosses a forked down tree bole or large branch connected to a down tree, tally each qualifying piece separately. To be tallied, each individual piece must meet the minimum diameter and length requirements.
12. In the case of forked trees, consider the "main bole" to be the piece with the largest diameter at the fork. Variables for this fork such as TOTAL LENGTH and DECAY CLASS should pertain to the entire main bole. For smaller forks or branches connected to a main bole (even if the main bole is not a tally piece), variables pertain only to that portion of the piece up to the point where it attaches to the main bole (see Figure 14-6).
13. If a transect intersects a nonforest condition (e.g., a road), CWD is not tallied in the nonforest condition.

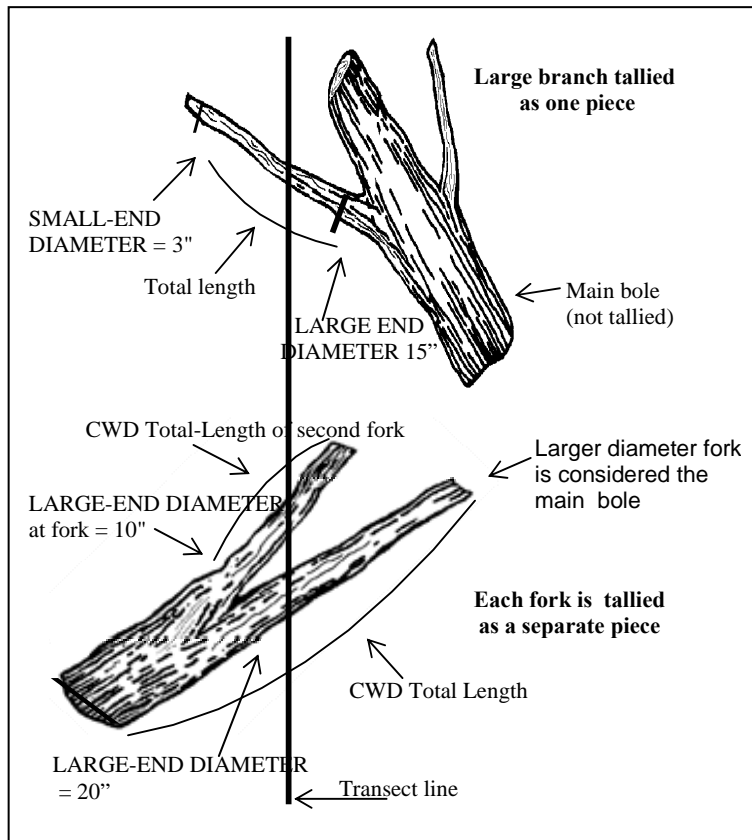


Figure 14-6. CWD tally rules for forked trees.

14.4.2 Marking CWD

Marking CWD is optional. Marked CWD is an aid to future crews returning to the plot for a QA check or to remeasure the plot at the next remeasurement period. Nails can be used to mark the location of the point of intersection, if the piece is in decay class 1, 2, or 3. Position the nail on top of the piece, and if possible, drive the nail into the piece so that about 1 inch of the nail is left exposed. Stop driving the nail if the next blow means breaking the piece or seriously disturbing the location of the piece. Please see section 14.3 Transect Line Segmenting, for information on the required marking of the transect line.

14.4.3 Recording Procedures for CWD

The tolerance for the total number of pieces (≥ 3 inches, transect diameter) tallied across all transects on the plot is : ± 2 piece or $\pm 5\%$, whichever is greater for the plot. Note: always round up to a whole piece count when using the 5% option.

14.4.3.1 SUBPLOT NUMBER

Record the code indicating the number of the subplot center from which the transect originates.

When collected: All tally pieces
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 4

- 1 Center subplot
- 2 North subplot
- 3 Southeast subplot
- 4 Southwest subplot

14.4.3.2 TRANSECT

Record the code indicating the azimuth of the transect on which the piece is sampled.

When Collected: All tally pieces
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

- 030 Transect extends 30 degrees from subplot center
- 150 Transect extends 150 degrees from subplot center
- 270 Transect extends 270 degrees from subplot center

14.4.3.3 CWD SLOPE DISTANCE

Record the code indicating the slope distance from the subplot center to the point where the transect intersects the longitudinal center of the piece. If two or more pieces have the same slope distances, record the top piece first. Measure and record to the nearest 0.1 feet. CWD SLOPE DISTANCE is an important item because it will be used to assign the CWD piece to a condition class by comparing the recorded distance to the piece with the recorded BEGINNING DISTANCE and ENDING DISTANCE to the condition class boundary. CWD SLOPE DISTANCE is also used to locate the piece for QA and remeasurement in future inventories.

When Collected: All tally pieces
Field width: 3 digits
Tolerance: +/- 1.0 ft
MQO: At least 90% of the time
Values: 00.1 to 99.9

14.4.3.4 CWD DECAY CLASS

Record a 1-digit code indicating the decay class of the piece. Code the decay class which predominates along the recorded CWD TOTAL LENGTH (14.4.3.7) of the piece. Use the guide below to determine CWD DECAY CLASS.

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October, 2007

When Collected: All tally pieces
 Field width: 1 digit
 Tolerance: +/- 1 class
 MQO: At least 90% of the time
 Values:

Decay Class	Structural Integrity	Texture of Rotten Portions	Color of Wood	Invading Roots	Branches and Twigs
1	Sound, freshly fallen, intact logs	Intact, no rot; conks of stem decay absent	Original color	Absent	If branches are present, fine twigs are still attached and have tight bark
2	Sound	Mostly intact; sapwood partly soft (starting to decay) but can't be pulled apart by hand	Original color	Absent	If branches are present, many fine twigs are gone and remaining fine twigs have peeling bark
3	Heartwood sound; piece supports its own weight	Hard, large pieces; sapwood can be pulled apart by hand or sapwood absent	Reddish-brown or original color	Sapwood only	Branch stubs will not pull out
4	Heartwood rotten; piece does not support its own weight, but maintains its shape	Soft, small blocky pieces; a metal pin can be pushed into heartwood	Reddish or light brown	Through-out	Branch stubs pull out
5	None, piece no longer maintains its shape, it spreads out on ground	Soft; powdery when dry	Red-brown to dark brown	Through-out	Branch stubs and pitch pockets have usually rotted down

Note: CWD DECAY CLASS 5 pieces can be difficult to identify because they often blend into the duff and litter layers. They must still resemble a log, therefore, the first tally rule is that they must be ≥ 5.0 inches in diameter, ≥ 5.0 inches from the surface of the ground, and at least 3.0 feet long. Decomposed logs that are slightly elevated 'humps' on the ground are not tallied.

CWD DECAY CLASS: The chart above was developed primarily for Douglas-fir in the Pacific Northwest. At the present time, there are no other charts available to use to describe decay classes for other species or locations. Concentrate on the structural integrity and texture when estimating a decay class for CWD logs.

If a log is case hardened (hard, intact outer sapwood shell) but the heartwood is rotten, code this log as a CWD DECAY CLASS 2 with a HOLLOW PIECE code of 1. CWD DECAY CLASS 1 should be reserved for 'freshly fallen' logs that are completely intact (i.e., recent windfalls, or harvest).

14.4.3.5 SPECIES

Record the code indicating the species of the piece. Species codes are the same as those used in P2 (see Appendix 3 of the P2 field guide). Because CWD includes the tally of large shrub boles and woody vines, enter a code of '0001' for SPECIES if the tally piece is a shrub or vine.

If the transect intersects the log at the decayed or splintered end (Figure 14-9) (i.e., the portion where we do not consider it part of the log because it is falling apart), record the diameter at this location as the intersect diameter, but record the large end and small end diameter according to our established rules (i.e., at the points where they best represent the log volume). If the splintered end appears to be two separate pieces (i.e., a major split located just at the end) – in this situation treat it as one log and take a diameter around the end (take two measurements if it is odd shaped). Length would be measured between the large and small end diameters.

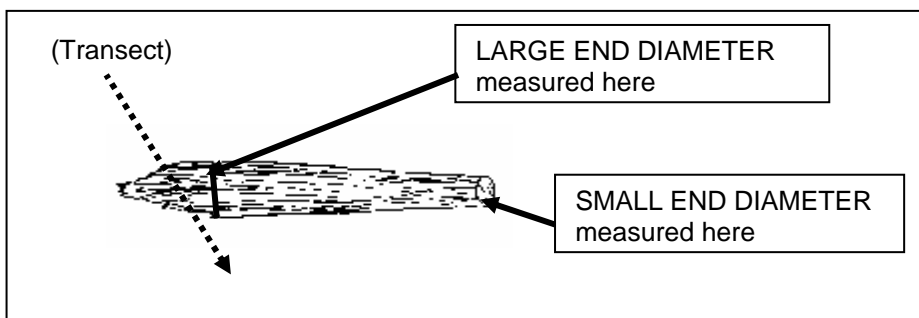


Figure 14-9. Example of decayed end intersecting the transect

14.4.3.6.1 DIAMETER AT POINT OF INTERSECTION

Record the code indicating the piece's diameter at the point where the transect intersects the longitudinal center of the piece. If the diameter is close to 3 inches, measure the diameter to the nearest 0.1 inch to determine if the piece is actually ≥ 3.0 inches and a valid tally piece. The diameter is recorded to the nearest inch.

When Collected: All tally pieces

Field width: 3 digits

Tolerance: Pieces < 20.0 in diameter: +/- 3 in
Pieces ≥ 20.0 in diameter: +/- 20%

MQO: At least 90% of the time

Values: 003 to 200

14.4.3.6.2 DIAMETER AT THE SMALL END

Record the code indicating the diameter at the piece's small end. The diameter is recorded to the nearest inch. The DIAMETER AT THE SMALL END occurs either at (1) the actual end of the piece, if the end has a diameter ≥ 3.0 inches, or (2) at the point where the piece tapers down to 3.0 inches in diameter. If the end is splintered or decomposing (sloughing off), measure the diameter at the point where it best represents the overall log volume. Use the same measuring procedures described in 14.4.3.6.1 (see Figure 14-7).

When Collected: CWD DECAY CLASS = 1 to 4

Field width: 3 digits

Tolerance Pieces < 20.0 in diameter: +/- 2 in
Pieces ≥ 20.0 in diameter: +/- 10%

MQO: At least 90% of the time

Values: 003 to 200

14.4.3.6.3 DIAMETER AT THE LARGE END

Record the code indicating the diameter at the piece's large end. The diameter is recorded to the nearest inch. The large end will occur either at a broken or sawn end, at a fracture, or at the root collar. If the end is splintered or decomposing (sloughing off), measure the diameter at the point where it best represents the overall log volume. Use the same measuring procedures used for 14.4.3.6.1.

When Collected: CWD DECAY CLASS = 1 to 4
Field width: 3 digits
Tolerance: Pieces < 20.0 in diameter: +/- 2 in
 Pieces ≥ 20.0 in diameter: +/- 15%
MQO: At least 90% of the time
Values: 003 to 200

14.4.3.7 CWD TOTAL LENGTH

Record the code indicating the total length of the piece. CWD TOTAL LENGTH is the length of the piece that lies between the piece's recorded DIAMETER AT THE SMALL END and DIAMETER AT THE LARGE END (14.4.3.6.2 & 14.4.3.6.3). For DECAY CLASS = 5, DIAMETER AT THE SMALL END and DIAMETER AT THE LARGE END are not recorded for a log, therefore the length is measured between the two physical ends of the log. For curved logs, measure along the curve. The minimum log length is 3.0 feet before it is a valid tally log. When the length is close to 3.0 feet, measure the length to determine if the piece is actually ≥ 3.0 feet. CWD TOTAL LENGTH is recorded to the nearest foot.

When Collected: All tally pieces
Field width: 3 digits
Tolerance: +/- 20%
MQO: At least 90% of the time
Values: 003 to 250

14.4.3.8 IS THE PIECE HOLLOW?

Record the code indicating whether or not the piece is hollow (see Figure 14-10).

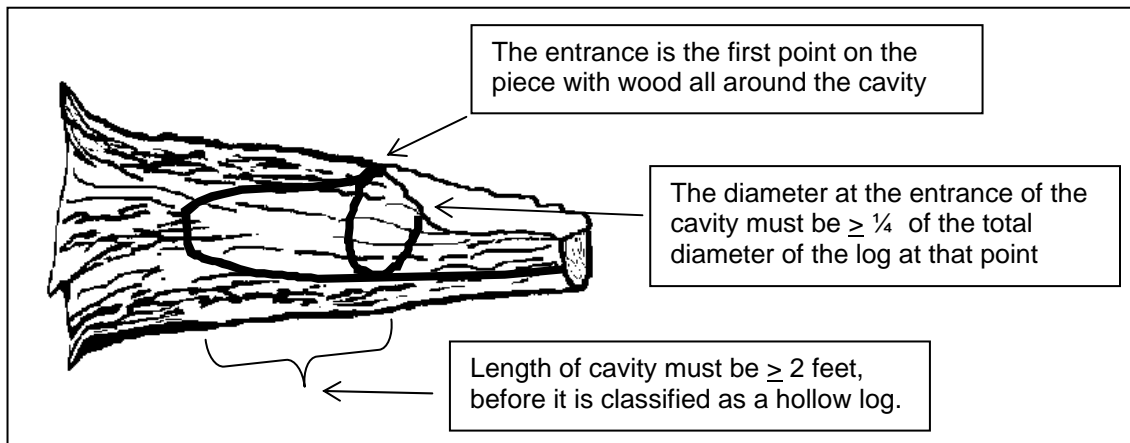


Figure 14-10. Determining if the piece is hollow.

When Collected: CWD DECAY CLASS = 1 to 4
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

- Y A piece is considered hollow if a cavity extends at least 2 feet along the central longitudinal axis of the piece, and the diameter of the entrance to the cavity is at least 1/4 of the diameter of the piece where the entrance occurs. The entrance occurs at the point where the circumference of the cavity is whole -- the point where wood is present completely around the circumference of the cavity. The length of the cavity begins at this point.
- N Does not meet criteria for being a hollow log

14.4.3.9 CWD HISTORY

Record the code that indicates whether or not the piece of CWD is on the ground as a result of harvesting operations or as a result of natural circumstances. One objective of this item is to identify those pieces that are considered logging residue. If the piece appears to have fallen to the ground as a result of natural causes such as decomposition or windfall, enter a code of 1. This category would include blown out tops, snapped off boles, wind-fallen trees on clearcut edges, and trees that basically collapsed and fell over due to decomposition.

If the piece is on the ground as a result of recent (since last annual remeasurement; if the plot is new, the time between the panel remeasurements) harvesting activity, either because the tree was cut down with a chainsaw (or other device) or pushed over by harvesting equipment (bulldozer), enter a code of 2. A code of 2 would be considered logging residue (usually you are in the middle of a recent clearcut).

If the piece is on the ground as a result of older (more than 15 years) harvesting activity, enter a code of 3. This would be a situation where you tally an old decomposing log that has a sawn end – if it appears that the log was cut and left on site, then enter a code of “3”.

If a piece is on the ground as a result of incidental harvest (such as a standing tree was cut for firewood or small clearing), enter a code of “4”. Incidental harvest involves a few trees and is not a part of a major organized harvesting operation.

If the crew cannot decide the history of the CWD log, classify it as “unknown”, and give it a code of “5”.

When Collected: CWD DECAY CLASS = 1 to 4
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

- 1 CWD piece is on the ground as a result of natural causes
- 2 CWD piece is on the ground as a result of major recent harvest activity (<= 15 yrs old)
- 3 CWD piece is on the ground as a result of older harvest activity (> 15 yrs old)
- 4 CWD piece is on the ground as a result of an incidental harvest (such as firewood cutting)
- 5 Exact Reason Unknown

14.5 SAMPLING METHODS FOR FINE WOODY DEBRIS (FWD)

1. Fine Woody Debris (FWD) is sampled in accessible forest land conditions. The length of FWD transects are measured in slope distance--no correction is applied to obtain a horizontal distance.

The FWD transects start at 14.0 feet slope distance and extend for 6.0 or 10.0 feet slope distance. Estimates of FWD biomass calculated in the office, will include a slope correction factor obtained from the transect segmenting data on the subplot.

2. Only sample FWD that intersects a plane from the ground to a height of 6 feet.
3. FWD is sampled in three size classes, on the 150 degree azimuth transect. Two of the FWD size classes (0.01 to 0.24 inches and 0.25 to 0.9 inches) are counted on a 6-foot transect, from 14 to 20 feet. Pieces in the third size class (1.0 to 2.9 inches) are counted on a 10-foot transect, from 14 to 24 feet (see section 14.2 for details on transects). These transects overlap. Note: individual diameters are not recorded for FWD.
4. Count a piece of FWD if it intersects the transect, and the condition class is accessible forest land at the point of intersection. Only count a piece if the twig, branch, wood fragment, or shrub/tree bole are woody. Do not count pine or fir needles or non-woody parts (e.g., petiole and rachis) of a tree or shrub.
5. Accumulate the number of pieces counted within each size class and enter the total count on one record for the subplot (unless there are >1 condition classes). If there is no tally on a transect, enter zeros for the count.
6. Accurate counts of FWD can be conducted efficiently up to about 50 pieces for small and medium size classes, and up to 20 pieces for the large size class. After that, crews can begin estimating counts in a systematic fashion. Transects that fall on very dense FWD where counting is nearly impossible, can be subsampled and calculated. For example, an accurate count can be conducted on a 2.0-foot section of the transect and then multiplied by 3 to provide an estimate for the 6 foot transect, as long as the crew feels that the remaining transect has a similar density of FWD pieces.
7. If a transect intersects a large pile of material such as a wood rat's nest or a recently fallen tree (with many attached fine branches), crews should estimate a count based on #6 above, but also enter a code indicating that this is an unusual situation (see section 14.5.6).
8. If rocks, logs, or other obstructions are present along the transect (14- to 24-foot section) include any FWD that is present on top of these obstructions in the respective FWD counts. If the obstructions are so large (huge boulder) that the top surface cannot be seen, assume the count is zero in this area, and continue counting if there is transect line beyond the boulder.
9. If a residue pile intersects the FWD transect at any point along the 14- to 24-foot section, do not measure FWD on this transect. It is too subjective determining exact boundaries of the pile, and how they relate to the exact point on the transect line. To identify this situation, code 1 in RESIDUE PILE ON TRANSECT which indicates that a residue pile has intersected the transect line.
10. If a transect crosses a condition class boundary, record the CONDITION CLASS NUMBER and enter a count for each condition on separate records. Transect lengths within each condition class will be obtained from the transect segmenting data entered for the subplot.

14.5.1 SUBPLOT NUMBER

Record the code indicating the subplot center from which the transect originates.

When collected: All tally segments

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 4

- 1 Center subplot
- 2 North subplot
- 3 Southeast subplot
- 4 Southwest subplot

14.5.2 CONDITION CLASS NUMBER

Record the code indicating the number of the condition class that pertains to the FWD count.

When collected: All tally segments

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 9

14.5.3 SMALL FWD COUNT

Record the number of pieces counted in this size class (0.01 to 0.24-inch diameter) along the transect segment. An accurate count should be conducted up to 50 pieces. If the count exceeds 50, the transect can be subsampled to estimate a total count for the transect segment (see 14.5, #6)

When collected: On the 150 degree transect in CONDITION CLASS STATUS = 1

Field width: 3 digits

Tolerance: 0 to 50 = +/- 20% of the total count for the transect

51 to 100 = +/- 25% of the total count for the transect

100 + = +/- 50% of the total count for the transect

MQO: At least 90% of the time

Values: 000 to 999

14.5.4 MEDIUM FWD COUNT

Record the number of pieces counted in this size class (0.25 to 0.9-inch diameter) along the transect segment. An accurate count should be conducted up to 50 pieces. If the count exceeds 50, the transect can be subsampled to estimate a total count for the transect segment (see 14.5, #6)

When collected: On the 150 degree transect in CONDITION CLASS STATUS = 1

Field width: 3 digits

Tolerance: +/- 20% of the total count for the transect

MQO: At least 90% of the time

Values: 000 to 999

14.5.5 LARGE FWD COUNT

Record the number of pieces counted in this size class (1.0 to 2.9 inch diameter) along the transect segment. An accurate count should be conducted up to 20 pieces. If the count exceeds 20, the transect can be subsampled to estimate a total count for the transect segment (see section 14.5, #6).

When collected: On the 150 degree transect in CONDITION CLASS STATUS = 1

Field width: 3 digits

Tolerance: +/- 20% of the total count for the transect

MQO: At least 90% of the time

Values: 000 to 500

14.5.6 HIGH COUNT REASON

Enter a code that applies to the situation encountered on the transect. Enter a code if any of the counts on a transect are greater than 100 pieces.

When Collected: When any count on the transect ≥ 100

Field width: 1 digit

Tolerance: No errors

MQO: At least 90% of the time

Values:

- 0 FWD is not unusually high
- 1 High count is due to an overall high density of FWD across the transect
- 2 Wood Rat's nest located on transect
- 3 Tree or shrub laying across transect
- 4 Other reason

14.5.7 RESIDUE PILE ON TRANSECT

Enter a code that indicates whether a residue pile intersects the FWD transect segment. The default is always 0; crews will enter a 1 if the situation is encountered on the transect.

When Collected: On all FWD transects (between 14 and 24 ft)

Field width: 1 digit

Tolerance: No errors

MQO: At least 90% of the time

Values:

- 0 No
- 1 Yes

14.6 DUFF, LITTER, AND FUELBED DEPTH MEASUREMENTS

Depth measurements are sampled in accessible forest land conditions. The depth of the duff layer, litter layer, and overall fuelbed are important components of fire models used to estimate fire behavior, fire spread, fire effects, and smoke production. These measurements are taken at the 24-foot location on each transect. An average depth will be calculated in the office and stored with other information about the condition class on the plot. If a residue pile, log, rock, or other obstruction intersects the transect at the 24-ft location, do not measure the duff or litter depth. But, do measure the fuelbed depth if the obstruction is a log or residue pile.

14.6.1 Definitions

1. Litter is the layer of freshly fallen leaves, needles, twigs (< 0.25 inch in diameter), cones, detached bark chunks, dead moss, dead lichens, detached small chunks of rotted wood, dead herbaceous stems, and flower parts (detached and not upright). Litter is the loose plant material found on the top surface of the forest floor. Little decomposition has begun in this layer.

Litter is flash fuel – so think about it as the loose material that is exposed to the air, capable of igniting quickly and carrying a fire across the surface of the forest floor.

Litter does not include bark that is still attached to a down log, or rotten chunks of wood that are still inside a decaying log or log end (i.e., if a decayed log end has a lot of rotten cubes or pieces laying on a log surface and exposed to air, they are considered part of the log and not litter – fire

would burn differently if it hit a pile of rotten punky wood chips, cradled by the unrotted sapwood shell). If these rotten chunks have spilled out to the ground and are actually on the ground surface, then they would be included in the litter layer.

Litter does not include animal manure.

Microplot estimates: As you look down on the microplot, litter is the material that you see covering the surface area of the 6.8-foot radius plot.

2. Duff is the layer just below litter. It consists of decomposing leaves and other organic material. You should see no recognizable plant parts, the duff layer is usually dark decomposed organic matter. When moss is present, the top of the duff layer is just below the green portion of the moss. The bottom of this layer is the point where mineral soil (A horizon) begins.
3. The fuelbed is the accumulated mass of dead, woody material on the surface of the forest floor. It begins at the top of the duff layer, and includes litter, FWD, CWD, and dead woody shrubs. In this definition, the fuelbed does not include dead hanging branches from standing trees.

14.6.2 Overview of Measurements

Depth measurements will be taken at the 24-foot (slope distance) location on each transect. If a log, rock or other obstruction occurs at the sample location, do not measure duff or litter depth, regardless of what is on top of the obstruction. However, if the obstruction is a log, proceed with the fuelbed depth estimate.

The DUFF, LITTER, AND FUELBED SAMPLE variable has three options for indicating if duff, litter, and/or fuelbed were measured at each sample location. The default value for this variable is 1, indicating that all three variables were measured (duff, litter, and fuelbed). A value of 0 is entered if duff and litter were not sampled (obstruction), but fuelbed was sampled. A value of 2 is entered if none of the three (duff, litter, and the fuelbed) were sampled (i.e., submerged part of plot).

14.6.2.1 Duff and Litter

The duff layer is the organic material layer between the A-horizon (or uppermost soil mineral horizon) and the litter layer. The duff is a soil layer dominated by organic material derived from the decomposition of plant and animal litter (pine straw, leaves, twigs, etc) and deposited on either an organic or a mineral surface. This layer is distinguished from the litter layer in that the original organic material has undergone sufficient decomposition that the source of this material (e.g., individual plant parts) can no longer be identified. Litter is defined as undecomposed or only partially decomposed organic material that can be readily identified (e.g., plant leaves, twigs, etc.). As a general rule, duff depth should rarely exceed a few inches. Crews should be absolutely sure they are measuring deep duff depths, instead of mineral soil layers or parts of the litter layer. Duff can easily weigh more than 6 times that of litter. If unsure of the bottom of the duff layer, crews should feel the texture of the suspect material in their hand. Rub the soil between your fingers. Does it crumble (duff) or feel more like modeling clay (mineral).

Carefully expose a shallow profile of the forest floor by digging out an area at the sample point using a knife, hatchet, or other tool. Estimate the depth of each layer with a ruler to the nearest 0.1 inch. If there is a log, rock, or other obstruction on the surface at the sample point, do not measure the litter or duff depth (record DUFF, LITTER, AND FUELBED SAMPLE = 0 or 2, depending if fuelbed can be sampled) ; a value of 99.9 will be entered by the TALLY program for each depth.

As you dig the hole for this measurement, if you encounter a rock, root, or buried log – stop the depth measurement at this point.

The height of the litter should be measured at the top of the loose material located at the sample point on the transect. Try to preserve the conditions of this location by walking around this point, so the QA staff will measure the same height as the original crew.

14.6.2.2 Fuelbed

Measure the height of the fuelbed from the top of the duff layer (just below the litter) to the highest piece of woody debris found at the transect point. Round to the nearest 0.1 foot. If a rock or other obstruction (other than a log) occurs at the 24.0-foot sample location, do not measure fuelbed depth.

14.6.3 SUBPLOT NUMBER

Record the code indicating the number of the subplot center from which the transect originates.

When collected: All tally segments

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 4

- | | |
|---|-------------------|
| 1 | Center subplot |
| 2 | North subplot |
| 3 | Southeast subplot |
| 4 | Southwest subplot |

14.6.4 TRANSECT

Record the code indicating the azimuth of the transect.

When collected: All tally segments

Field width: 3 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

- | | |
|-----|--|
| 030 | Transect extends 30 degrees from subplot center |
| 150 | Transect extends 150 degrees from subplot center |
| 270 | Transect extends 270 degrees from subplot center |

14.6.5 DUFF, LITTER, AND FUELBED SAMPLE

Record the code indicating if the depth of the duff and litter layer was measured.

When collected: At 24.0 ft on each transect

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- | | |
|---|--|
| 0 | Duff and litter depth not sampled; Fuelbed is sampled |
| 1 | All sampled: Duff, litter, and fuelbed |
| 2 | Nothing sampled; Duff, litter, fuelbed are not sampled |

14.6.6 DUFF DEPTH

Record the code indicating the depth of the duff layer to the nearest 0.1 inch.

When collected: At 24.0 ft on each transect

Field width: 3 digits

Tolerance: +/- 0.5 inch

MQO: At least 90% of the time

Values: 00.0 to 99.9

14.6.7 LITTER DEPTH

Record the code indicating the depth of the litter layer to the nearest 0.1 inch.

When collected: At 24.0 ft on each transect

Field width: 3 digits

Tolerance: +/- 0.5 inch

MQO: At least 90% of the time

Values: 00.0 to 99.9

14.6.8 FUELBED DEPTH

Record the code indicating the depth of the fuelbed layer, to the nearest 0.1 foot. If the fuelbed depth is >0 and ≤ 0.1 foot enter 0.1foot. In this situation finer depth resolution will be obtained from the duff and litter measurements.

When collected: At 24.0 ft on each transect

Field width: 3 digits

Tolerance: +/- 20%

MQO: At least 90% of the time

Values: 00.0 to 99.9

14.7 FUEL LOADING ON THE MICROPLOT

Another component of the total fuel loading on a plot is the biomass of live and dead understory material. The 6.8-foot radius microplot will be used to estimate the percent cover and height of live and dead shrubs, live and dead herbs (includes grasses) and litter. Fuel loading is estimated in accessible forest land conditions on the microplot. Enter one value for all forested conditions combined. The sum of all individual covers (e.g., live shrubs, dead herbs, etc.) can exceed 100 percent.

Shrubs are plants with woody stems, including woody vines. Herbs are non-woody herbaceous plants, but also include ferns, mosses, lichens, sedges, and grasses. Although many forbs and grasses will die by the end of the growing season, an estimate of live and dead biomass on a given date will help fire modelers predict the phenology of herbaceous material during the year, allowing them to estimate fire danger patterns across the landscape.

Percent cover is estimated for each of the five fuel categories (live shrubs, dead shrubs, live herbs, dead herbs, and litter) in 10-percent classes for the accessible forested conditions of the microplot. For live fuels, estimate the percent of the microplot area that is covered by live plant material. Include whole plants that are entirely green (or alive) and the live branches on plants that are a mixture of live and dead plant parts. Include live branches or leaves that extend into the microplot area from a plant that is actually rooted outside of the microplot. Do not include herbaceous material above 6 feet (i.e., moss, ferns, lichens, epiphytes that are growing in tree branches above 6 feet).

For dead fuels, estimate the percent cover using the same procedures as live fuels, but include plants that are entirely dead and branches or leaves that are dead but still attached to a live plant. Dead plant material must be clearly visible. Do not include dead material that has fallen to the ground. Cover

estimates are made by visualizing an outline around the dead material (with all 'air' space included) and accumulating this across the forested microplot area.

An estimate of the total height of the shrub and herbaceous layers is also needed to calculate biomass and fuel loadings. Record a height estimate for each fuel category, except litter. Height is estimated for the tallest shrub on the microplot.

Microplot Cover Estimation Guide (Hint: 8.5" x 11" = about 0.5% coverage)

%	area (sq ft)	radius (ft)	square (ft)
1	1.45	0.68	1.20
10	14.52	2.15	3.81
20	29.04	3.04	5.39
30	43.56	3.72	6.60
40	58.08	4.30	7.62
50	72.60	4.81	8.52
60	87.12	5.27	9.33
70	101.64	5.69	10.08
80	116.16	6.08	10.78
90	130.68	6.45	11.43
100	145.2	6.80	12.05

14.7.1 SUBPLOT NUMBER

Record the code indicating the number of the subplot center from which the transect originates.

When collected: All microplots with at least one CONDITION CLASS STATUS = 1

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 4

- 1 Center subplot
- 2 North subplot
- 3 Southeast subplot
- 4 Southwest subplot

14.7.2 LIVE SHRUB PERCENT COVER

Record the code for the cover class that indicates the percent cover of the forested microplot area covered with live shrubs.

When collected: All microplots with at least one CONDITION CLASS STATUS = 1

Field width: 2 digits

Tolerance: +/- 1 class

MQO: At least 85% of the time

Values:

- 00 Absent
- 01 Trace (< 1% cover)
- 10 1 – 10%
- 20 11-20%
- 30 21-30%
-
- 90 81-90%
- 99 91-100%

14.7.3 LIVE SHRUB HEIGHT

Record the code indicating the height of the tallest shrub to the nearest 0.1 foot. Measure heights < 6 feet and estimate heights \geq 6 feet.

When collected: All microplots with at least one CONDITION CLASS STATUS = 1
Field width: 3 digits
Tolerance: +/- 0.5 ft
MQO: At least 90% of the time
Values: 00.0 to 99.9

14.7.4 DEAD SHRUBS PERCENT COVER

Record the code for the cover class that indicates the percent cover of the forested microplot area covered with dead shrubs and dead branches attached to live shrubs if visible from above.

When collected: All microplots with at least one CONDITION CLASS STATUS = 1
Field width: 2 digits
Tolerance: +/- 1 class
MQO: At least 85% of the time
Values:

00	Absent
01	Trace (< 1% cover)
10	1 – 10%
20	11-20%
30	21-30%
....	
90	81-90%
99	91-100%

14.7.5 DEAD SHRUB HEIGHT

Record the code indicating the height of the tallest dead shrub to the nearest 0.1 foot. Measure heights < 6 feet and estimate heights \geq 6 feet.

When collected: All microplots with at least one CONDITION CLASS STATUS = 1
Field width: 3 digits
Tolerance: +/- 0.5 ft
MQO: At least 90% of the time
Values: 00.0 to 99.9

14.7.6 LIVE HERBS PERCENT COVER

Record the code for the cover class that indicates the percent cover of the forested microplot area covered with live herbaceous plants.

When collected: All microplots with at least one CONDITION CLASS STATUS = 1
Field width: 2 digits
Tolerance: +/- 1 class
MQO: At least 85% of the time

Values:

00	Absent
01	Trace (< 1% cover)
10	1 – 10%
20	11-20%
30	21-30%
....	
90	81-90%
99	91-100%

14.7.7 LIVE HERBS HEIGHT

Record the code indicating the height (at the tallest point) of the live herbaceous layer to the nearest 0.1 foot. Maximum height is 6 feet.

When collected: All microplots with at least one CONDITION CLASS STATUS = 1

Field width: 2 digits

Tolerance: +/- 0.2 ft

MQO: At least 90% of the time

Values: 0.0 to 6.0

14.7.8 DEAD HERBS PERCENT COVER

Record the code for the cover class that indicates the percent cover of the forested microplot area covered with dead herbaceous plants and dead leaves attached to live plants if visible from above.

When collected: All microplots with at least one CONDITION CLASS STATUS = 1

Field width: 2 digits

Tolerance: +/- 1 class

MQO: At least 85% of the time

Values:

00	Absent
01	Trace (< 1% cover)
10	1 – 10%
20	11-20%
30	21-30%
....	
90	81-90%
99	91-100%

14.7.9 DEAD HERBS HEIGHT

Record the code indicating the height (at the tallest point) of the dead herbaceous layer to the nearest 0.1 foot. Maximum height is 6 feet.

When collected: All microplots with at least one CONDITION CLASS STATUS = 1

Field width: 2 digits

Tolerance: +/- 0.2 ft

MQO: At least 90% of the time

Values: 0.0 to 6.0

14.7.10 LITTER PERCENT COVER

Record the code for the cover class that indicates the percent cover of the forested microplot area covered with litter. Litter is the layer of freshly fallen leaves, twigs, dead moss, dead lichens, and other fine particles of organic matter found on the surface of the forest floor. Decomposition is minimal.

When collected: All microplots with at least one CONDITION CLASS STATUS = 1

Field width: 2 digits

Tolerance: +/- 1 class

MQO: At least 85% of the time

Values:

00	Absent
01	Trace (< 1% cover)
10	1 – 10%
20	11-20%
30	21-30%
....	
90	81-90%
99	91-100%

14.8 SAMPLING RESIDUE PILES

The line transect method is not practical when sampling CWD within piles and windrows. Piles and windrows will be located and sampled on the subplot plot, regardless of whether they intersect a transect.

Piles and windrows created directly by human activity and log piles at the bottom of steep-sided ravines in which individual pieces are impossible to tally separately, are more efficiently sampled by using the following instructions. However, loose CWD in piles created by wind throw, landslides, fires, and other natural causes should be tallied using line transects unless it is physically impossible to measure the pieces in the natural pile.

For a pile to be tallied on a subplot that contains forest land, all of the following criteria must be met (Figure 14-11):

- The pile's center must be within 24.0 horizontal feet of subplot center,
- The pile's center must be in an accessible forest land condition class, and
- The pile contains pieces of CWD \geq 3 inches diameter that would be impossible to tally separately.

Use the PILE DENSITY variable to estimate the percent of the pile that contains woody material \geq 3 inches.

The pile is assigned to the condition class in which the pile center lies.

Apply the following steps to determine the center of a pile or windrow:

1. Determine the longest axis of a pile.
2. Determine the midpoint of this axis.
3. Project a line through this midpoint that is perpendicular to the axis determined in step 1.
4. Determine the midpoint of the segment of this projected line that crosses the pile.
5. This is the center of the pile.

Piles that cross the 24.0-foot fixed-radius subplot boundary: If the center of a pile is within 24.0 horizontal feet of subplot center, tally the pile, recording the dimensions of the entire pile even if part of the pile is beyond 24.0 feet. If the center of a pile is more than 24.0 horizontal feet of subplot center, do not tally the pile or any portion of the pile.

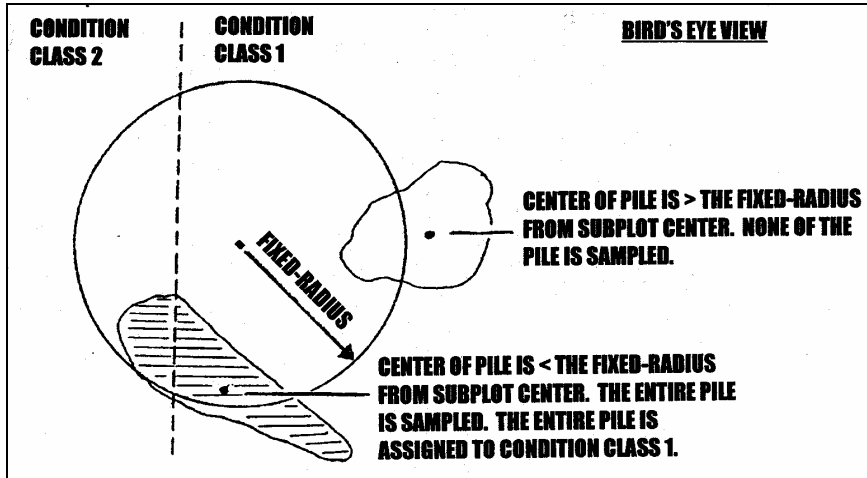


Figure 14-11. Residue pile selection examples.

14.8.1 SUBPLOT NUMBER

Record the code indicating the subplot number.

When collected: Record for all sampled residue piles

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 4

- 1 Center subplot
- 2 North subplot
- 3 Southeast subplot
- 4 Southwest subplot

14.8.2 CONDITION CLASS

Record the code indicating the number of the condition class to which the pile is assigned.

When collected: Record for all sampled residue piles

Field Width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 9

14.8.3 PILE AZIMUTH

Record the code indicating the azimuth from the subplot center to the pile. This azimuth centers on the pile so that it can be relocated. Use 360 for north.

When collected: All sampled residue piles
 Field width: 3 digits
 Tolerance: +/- 10
 MQO: At least 90% of the time
 Values: 001 to 360

14.8.4 PILE SHAPE

Record the code indicating the shape of the pile. Determine which of the four shapes diagrammed in Figure 14-12 most resembles the pile and record the dimensions. Pile dimensions should be ocularly smoothed out when making estimates. Average the unevenness of protruding pieces.

When collected: All sampled residue piles
 Field width: 1 digit
 Tolerance: No errors
 MQO: At least 90% of the time
 Values: 1 to 4

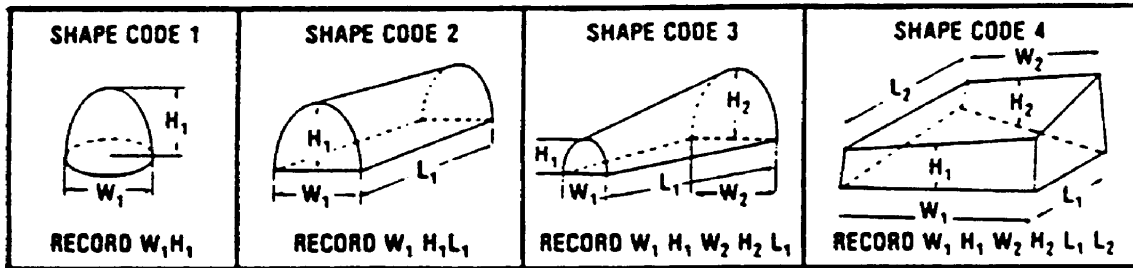


Figure 14-12. PILE SHAPE codes (Hardy 1996).

14.8.5 PILE LENGTH 1

Record the code indicating the length of the sides of the pile. Estimate to the nearest foot. PILE LENGTH 1 may often equal PILE LENGTH 2.

When collected: All sampled residue piles and PILE SHAPE = 2, 3, 4
 Field width: 2 digits
 Tolerance: +/- 10%
 MQO: At least 90% of the time
 Values: 01 to 99

14.8.6 PILE LENGTH 2

Record the code indicating the length of the sides of the pile. Estimate to the nearest foot. PILE LENGTH 1 may often equal PILE LENGTH 2.

When collected: All sampled residue piles and PILE SHAPE = 4
 Field width: 2 digits
 Tolerance: +/- 10%
 MQO: At least 90% of the time
 Values: 01 to 99

14.8.7 PILE WIDTH 1

Record the code indicating the width of the sides of the pile. Estimate to the nearest foot. PILE WIDTH 1 may often equal PILE WIDTH 2.

When collected: All sampled residue piles, and PILE SHAPE = 1, 2, 3, 4
Field width: 2 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 01 to 99

14.8.8 PILE WIDTH 2

Record the code indicating the width of the sides of the pile. Estimate to the nearest foot. PILE WIDTH 1 may often equal PILE WIDTH 2.

When collected: All sampled residue piles, and PILE SHAPE = 3, 4
Field width: 2 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 01 to 99

14.8.9 PILE HEIGHT 1

Record the code indicating the height of either end of the pile. Estimate to the nearest foot. PILE HEIGHT 1 may often equal PILE HEIGHT 2.

When collected: All sampled residue piles, and PILE SHAPE = 1, 2, 3, 4
Field width: 2 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 01 to 99

14.8.10 PILE HEIGHT 2

Record the code indicating the height of either end of the pile. Estimate to the nearest foot. PILE HEIGHT 1 may often equal PILE HEIGHT 2.

When collected: All sampled residue piles, and PILE SHAPE = 3, 4
Field width: 2 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 01 to 99

14.8.11 PILE DENSITY

Record the code estimating the percent of the pile that consists of wood. Use the PILE DENSITY variable to estimate the percent of the pile that contains woody material ≥ 3 inches. Air, soil, rock, plants, etc, should be factored out of the estimate. Estimate to the nearest 10 percent.

When collected: All sampled residue piles

Field width: 2 digits

Tolerance: +/- 20%

MQO: At least 75% of the time

Values:

00	Absent
01	Trace (< 1% cover)
10	1 – 10%
20	11-20%
30	21-30%
....	
90	81-90%
99	91-100%

14.9 LITERATURE CITED

Hardy, C.C. 1996. Guidelines for estimating volume, biomass, and smoke production for piled slash. Gen. Tech. Rep. PNW-364. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 21 p.

14.10 ACKNOWLEDGEMENTS

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