

Cumberland Piedmont Network

National Park Service
Inventory and Monitoring Division



Standard Operating Procedure 8

Coarse Woody Debris Measurements—Version 1.35

Please cite this as:

Cumberland Piedmont Network. 2023. Coarse woody debris measurements—Version 1.35.
Cumberland Piedmont Network Standard Operating Procedure NPS/CUPN/SOP—8. Cumberland
Piedmont Network, Mammoth Cave, Kentucky.

Overview

Coarse woody debris includes downed trees and large branches on the ground. As logs deteriorate on the ground, they provide special habitat for many animals, fungi, bryophytes, and other forest organisms. The amount of coarse woody debris is an important indicator of ecological health or integrity. Unlike managed forests with high levels of timbering, the forests on the lands of the National Park Service include extensive areas where most trees contribute to coarse woody debris at the end of their lives instead of being harvested. In addition to being a special wildlife resource, coarse woody debris also contributes to forest fuel loads. Knowing about forest fuel loading on the landscape can enable better understanding of wildland fire risk.

For measuring coarse woody debris, use the 40.0-meter (131.2 feet [ft]) crossed tapes that were laid out in an east/west and north/south direction when establishing the plot, as described in SOP 3 *Site Selection and Plot Establishment—Version 1.48* (CUPN 2023). During plot revisits, you will need to use the 30-meter (98.4 ft) tape to add 10 meters (32.8 ft) to the west and east ends of the east/west transect, as the tapes were laid out differently than they were during plot establishment.

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Step by Step Instructions

Starting at one end of either the 40.0-meter (131.2 ft) east/west (X axis) or north/south (Y axis) crossed tapes, tally each piece of coarse woody debris (CWD) that intersects with the line. To be tallied in this protocol, the CWD piece must be greater than or equal to 7.5 centimeters (3.0 inches [in]) diameter and greater than or equal to 1.0 meter (3.3 ft) long. The CWD also includes dead trees leaning >45 degrees from vertical, measured along the bole (tree trunk).

CWD does not include:

- Woody pieces less than 7.5 centimeters (3.0 inches) in diameter at the point of transect intersection.
- Woody pieces less than 1.0 meter in length.
- Dead trees leaning 0 to 45° from vertical as these are recorded as snags, not CWD.
- Trees showing any sign of life.
- Stumps that are rooted in the ground (i.e., not uprooted).
- Bark that is no longer attached to a bole or limb. Bark attached to a piece is counted.
- Roots or main bole below the root collar.
- Very decomposed logs reduced to slightly elevated “humps” on the ground without structural integrity, and less than 12.7 centimeters (5.0 in) in height from the surrounding forest floor.
- The top of a dead tree if it is partially broken and leaning over horizontal to the forest floor, and there is less than a 50% breakage of the leaning dead top with the appropriate lean.

On the datasheet record the transect (X or Y) that the piece intersects, where the tape running east/west is the X transect and the tape running north/south is the Y transect. With the aid of a Biltmore stick (or DBH [diameter breast height] tape if more convenient) record diameter to nearest centimeter where the piece intersects the transect and also assign it a decay class (Table 1). Do not use a meterstick to measure the CWD diameter.

Some tips on using the Biltmore stick:

- Keep the stick perpendicular to your reach
- Hold the stick the right distance from your eye (25 inches [63.5 centimeters] is standard)
- Do not move your head when reading the far end (this causes a shift in the intersect with the piece of wood you are measuring)

If the log is hollow and could provide cover or habitat for a small mammal then record it as hollow by writing “yes” in the “Hollow?” column on the datasheet, otherwise “no.” Finally, in the Notes column record anything unusual about the transect placement or the pieces of CWD (e.g., elevated above the ground). If the tree species of the CWD can be easily identified, record that information in this space. Use this space to identify which pieces of CWD are connected to each other, or which diameters were measured from the same piece of CWD, if the same piece crosses a transect more than once.

On occasion a transect may be less than 40.0 meters (131.2 ft) in length. This can happen when the transect would extend outside the park boundary or within a maintained right-of-way where CWD would be cleared. In those cases, the shortened transect length should be recorded in the appropriate field on the top of the field form.

Once finished with the first transect of 40.0-meter length, proceed to the second transect that was laid out and record all coarse woody debris along that transect as well.

Also, don’t forget to put your initials on the top of the datasheet, as the data taker.

Table 1. Coarse woody debris and snag decay classes adapted from Pyle and Brown (1998) and U.S. Forest Service (2005).

Class	Bark	Log shape and integrity	Color of exposed wood	Texture of rotten portions	Primary surface substrate	Branches and twigs
1	Firmly attached	Round and solid. Freshly fallen, intact logs	Fresh color, not stained by weathering	Intact, no rot or conks. Stem decay absent.	Sound, tight bark	Branches retain many small twigs
2	If present, decayed, faded and not firmly attached	Round and solid	May be bleached and relatively smooth (like driftwood)	Mostly intact, sapwood partly soft and starting to decay, but can't be pulled apart by hand	Decayed bark and hard wood - impenetrable with fingernail or pen point, may be case hardened with power wood beneath	Branches retain some small twigs, often with peeling bark
3	Generally absent, except in <i>Betula</i> and <i>Prunus</i>	Round and firm, piece supports its own weight	Reddish-brown, or original color	Hard, large pieces of sapwood can be pulled apart by hand.	Soft wood—will spring back if compressed, easily penetrated with fingernail or pen point	No small twigs, but branch stubs will not pull out
4	Absent	Oval or flattened, no longer a solid piece, though some hard chunks remain. Piece does not support its own weight, but maintains its shape	Reddish or light brown	Soft, small blocky pieces, a metal pin can be pushed into heartwood	Very spongy wood—responds to finger pressure and may exude moisture. Powder wood flows through fingers like coarse sawdust	No small twigs, branch stubs pull out
5	Absent	Quite flat or flat with some rounding. Piece no longer maintains its shape, but spreads out on the ground, is at least 12.7 centimeters (5.0 in) high	Red-brown to dark brown	Soft, powdery when dry	Loosely aggregated powder wood	No small twigs. Branch stubs and pitch pockets have usually rotted down

Equipment List

- Biltmore stick or DBH (diameter breast height) tape
- Chaining Pin
- 30-meter (98.4 ft) tape
- Two 50-meter tapes, also used for plot set up

Completing Field Data Forms

A detailed list of field descriptions for each field on the field data form associated with this SOP, (Figure 1) can be found below in Table 2.

Table 2. Field data form field names and descriptions for this SOP.

Field Name	Field Description
Data Taker Initials	Initials of individual collecting the data. In some cases, there will be one person calling out data, while another records. Data taker initials should be the one with greatest knowledge and experience overseeing the calls being made.
Reviewed by	Initials of individual who reviewed completed data sheet for elements in this SOP. Ideally this should be someone other than individual who recorded data on this portion of datasheet.
Transect X length and Transect Y length	Default length is 40 meters (131.2 ft). However, in some instances a transect may be shortened if it intersects a restricted area such as a road or regularly mowed area or if it hits the park boundary. This field will be pre-populated on revisit forms, correct/update if necessary.
Transect	Circle X or Y, where X is the tape measure running east/west and Y is the tape measure running north/south.
Diameter	Measure diameter of coarse woody debris (CWD) with aid of Biltmore stick or DBH (diameter breast height) tape (in centimeters) to nearest centimeter.
Decay Class	Assign the piece to one of the five decay class categories listed on the bottom of the datasheet.
Hollow	If the log is hollow and could provide cover or habitat for a small mammal then record it as hollow by writing yes on the datasheet, otherwise no.
Notes	Record anything unusual about the transect placement or the pieces of CWD. If the tree species of the CWD can be easily identified, record that information in this space. Use this space to identify which pieces of CWD are connected to each other, or which diameters were measured from the same piece of CWD, if the same piece crosses a transect more than once.

Literature Cited

- Cumberland Piedmont Network. 2023. Site selection and plot establishment—Version 1.48. Cumberland Piedmont Network Standard Operating Procedure NPS/CUPN/SOP—3. Cumberland Piedmont Network, Mammoth Cave, Kentucky. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2299604> (last accessed October 2023).
- White, R., C. Nordman, L. Smart, T. Leibfreid, B. Moore, R. Smyth, and T. Govus. 2011. Vegetation monitoring protocol for the Cumberland Piedmont Network, Version 1. Natural Resource Report NPS/CUPN/NRR—2011/XXX. National Park Service. Fort Collins, Colorado.
- Pyle, C. and M. M. Brown. 1998. A rapid system of decay classification for hardwood logs of the eastern deciduous forest floor. *Journal of the Torrey Botanical Society* 125: 237-245.
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Revision Log

Revision History Log.

Version #	Date	Revised by	Changes
1.1	01/15/12	B. Moore and R. White	Minor editorial changes adding clarification following initial field season. In addition to Biltmore stick, added DBH tape as an acceptable method of measuring diameter if more convenient. Reminder to add data taker initials on data form
1.2	9/27/12	B. Moore and R. White	Minor editorial changes to reduce confusion after 2012 field season.
1.3	4/7/18	C. Bledsoe	Changed “Time allotted” to “Time estimate.” Added tips on using Biltmore stick. Minor editorial changes to reduce confusion and incorporate plot revisits.
1.31	3/24/2020	B. Moore	Moved Revision History to end of SOP and added more detailed list of changes made to date.
1.32	8/10/2020	B. Moore	Address grammatical changes and clarifying comments made by IMD regional program manager.
1.33	2/19/2021	B. Moore	Added image of field data form and table of field data form descriptions (moved from SOP 14).
1.35	8/7/2023	–	Formatted by editor to regional I&M publication standards.