Protocol for estimating nominal volume of woody debris

CTFS Global Forest Carbon Research Initiative
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Equipment

1) Compass
2) Measuring tape of 2 m (preferably metallic lockable)
3) Marking crayon / Chalk or colorful plastic string of 11 m (if coordinate points marked every 5 m a 6 m string is sufficient)
4) Small caliper (0-50 mm)
5) Large caliper (0-1270 mm)
6) Large modified caliper (0-1270 mm)
7) Diameter tape
8) Decaymeter
9) Protractor
10) Sheet holder
11) Forms
12) Pencil

General procedure

Woody debris is above-ground fallen wood and bark of stems, branches (and exceptionally roots, see Fig. 1) of dead trees at least 20 mm in diameter (or width). To determine whether a tree is dead or alive the local definitions used in the main CTFS census should be used. The remains of woody debris are considered soil if the material is powdery (particle diameter less than 5 mm) and gravity has flattened the remains so that the height of a cross section is less than 20 % of the width (Fig. 2). The piece is not considered fallen woody debris if it is not supported by its branches or stem touching the ground in at least three locations.

The nominal volume of fallen woody debris is estimated using line-intercept surveys in which dimensions of pieces of woody debris on the transect are measured at the point where they cross the transect (Fig. 3). If a given piece crosses the transect twice it is measured at both intersections (Fig. 4 and Fig. 5) The transects are spaced 20 m apart (10 m apart in plots with an area of 25 hectares or less) and are all oriented South-North (parallel to two edges of the plot). The most westerly transect is 20 m from the western border of the plot and the most easterly 20 m from the eastern border of the plot (only 10
m from the borders in a plot with an area of 25 hectares or less). Note that the estimation of woody debris density, described in a separate document, should be carried out on some of the transects at the same time.

1) Go to the southern end of a transect and observe whether the first 0.2 m of the transect crosses with pieces of woody debris with a diameter of 20-99 mm at the crossing point. If yes, make sure using the measuring tape that the crossing point of the transect and the central axis of the piece of woody debris really is less 0.2 m from the southern end (keep the measuring tape horizontal also in slopes) and measure the diameter with a caliper perpendicularly to the central axis of the piece when looking from above. The exact direction should be preferably determined by being able to see the next coordinate point mark (Fig. 6). If this is not possible the compass direction should be used (if the plot is not aligned to the magnetic North make the respective adjustment).

2) Observe the first 2 m of the transect (keep the measuring tape horizontal also in slopes) for pieces with a diameter of 100-299 mm. If there are one or several pieces measure their diameter. For all pieces with a diameter of 100 mm or more also measure the decay stage and angle and record whether more than 50 % of the original amount of leaves or bark is still attached in the piece of woody debris. Note that the diameter is measured perpendicularly to the central axis (when looking from above). Determine the decay stage with a decay meter by inserting the instrument vertically at the highest point of the cross section and recording the penetration (Fig. 7). Measure the angle of the central axis of the piece at the intersection with a ten degrees accuracy (the direction away from the base when the piece was part of a living tree pointing North 0º, East 90º, South 180º, West 270º) with a protractor or compass (Fig. 8). Using a compass instead of a protractor is recommended but the deviation between magnetic North and true North needs to be recorded.

3) Observe the first 20 m of the transect for pieces with a diameter of 300-1249 mm and measure them in the same way as pieces with a diameter of 100-299 mm (diameter, angle, the stage of decay and attachment of leaves and bark). An error of 0.5 m in the location of the intersection is acceptable so simply walk towards the next coordinate mark and carry out the measurements on the way. The intersection should be located more accurately if a very large pieces of woody debris ends close the transect. In this case a person standing at one coordinate mark can check whether the piece should be included or not by simultaneously watching the next coordinate mark and the end of the piece of woody debris.

4) Observe the first 20 m of the transect for pieces with a diameter of 1250 mm and over (there will possibly be none in the whole plot). Determine the intersection of the transect and the central axis of the piece of woody debris in the same way as for pieces with a diameter of 300-1249 mm and measure the circumference with a diameter tape in addition to the other observations. If the tape can be passed beneath the piece this should be done. If this is impossible measure only upper half of the
piece and multiply the reading by two before recording it. Great care must be taken to measure exactly the upper half (distance between the locations over the piece in which the caliper would touch the piece when measuring diameter) (Fig. 9).

Repeat the procedures described above for stretches of 0.2 m, 2 m and 20 m starting from 20 m, 40 m etc. from the southern end of the transect.
Fig. 1. Dead above-ground parts of roots are considered woody debris. The photo shows remains of a buttress at the time when the stem was completely decomposed.
Fig. 2. These remains of a stem or large branch are still woody debris as the pieces are solid enough to be lifted. Powdery remains are woody debris only if their height is more than 20% of the width of the cross-section.
Fig. 3. Measure the diameter of the piece of woody debris perpendicularly to the central axis of the central axis of the piece of woody debris at the intersection of the transect (upper edge of the measuring tape) and the central axis of the piece of woody debris.
Fig. 4. The central axes of a piece of wooden debris are shown in red. They run in the through the centroids of the cross sections. When a piece of woody debris is branching the central axis becomes several as shown. Note that the lower axis stops on the line running between the lower ends of the upper axes so that depending on the location of the transect one or two dimensions of cross sections are measured (but never three with a simple forking). If the transect runs at the location of the measuring tape measure the dimensions of the cross section shown in blue.
Fig. 5. The central axes of a piece of wooden debris are shown in red. If the transect runs at the location of the measuring tape measure the dimensions of the cross sections shown in blue. Note that the dimensions are measured exactly at the intersections and deformations are not avoided.
Fig. 6. The easiest way to aim the measuring tape is to do it based on the coordinate marks permanently set in the plot. If the visibility is not excellent another person should indicate the location of the mark to the North.
Fig. 7. Assess the stage of decay with a decaymeter.
Fig. 8. Estimate the angle between the central axis and the transect for all pieces of coarse woody debris. Some people might find a protractor with two parts easier to use. Alternatively a compass can be used especially when visibility is bad (remember to make a correction if the plot is aligned to the magnetic North).
Fig. 9. Use diameter tape to measure the circumference of very large pieces of woody debris (diameter at least 1250 mm). If the tape cannot be passed beneath the piece measure only the upper half. Make sure to measure exactly from and to the location where the tape first and last touches the piece indicated with a yellow arrow and multiply by two to get the full circumference.