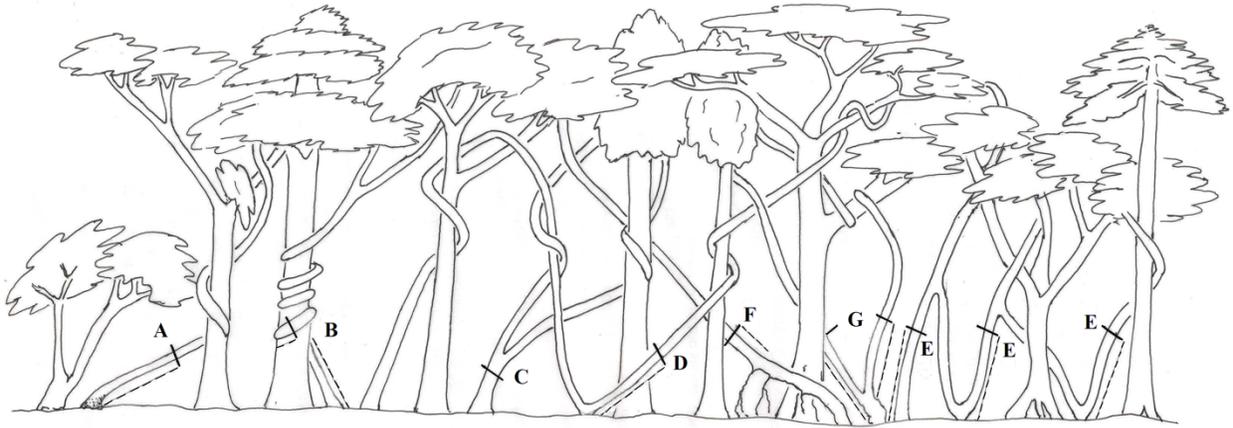


APPENDIX A: Protocol for Determining Liana Diameter Measurement Location

From: Schnitzer *et al.* 2008, *Forest Ecology & Management* 255:1044-1049



Reprinted from Gerwing *et al.* 2006

- A) Measure the diameter of all lianas (≥ 1 cm) 130 cm from the main rooting point at the soil surface.
- B) Measure twining lianas 130 cm from the rooting point, along the stem of the liana.
- C) If lianas branch below 130 cm (but ≥ 40 cm from the roots), measure 20 cm below the branching point.
- D) If lianas loop to the ground and root before ascending into the canopy, ignore the loop and measure 130 cm from the last rooting point along the stem that ascends into the canopy.
- E) If lianas loop to the ground and root (like in D), but the loops have branches that ascend to the canopy, measure each rooted ascending stem of the individual separately and use the multiple stem datasheet.
- F) If lianas have adventitious roots > 130 cm from the main rooting point, measure 50 cm above highest rooted adventitious root.
- G) If lianas branch < 40 cm from the rooting point, measure each branch of the individual separately at 130 cm above the main rooting point and use the multiple stem datasheet.

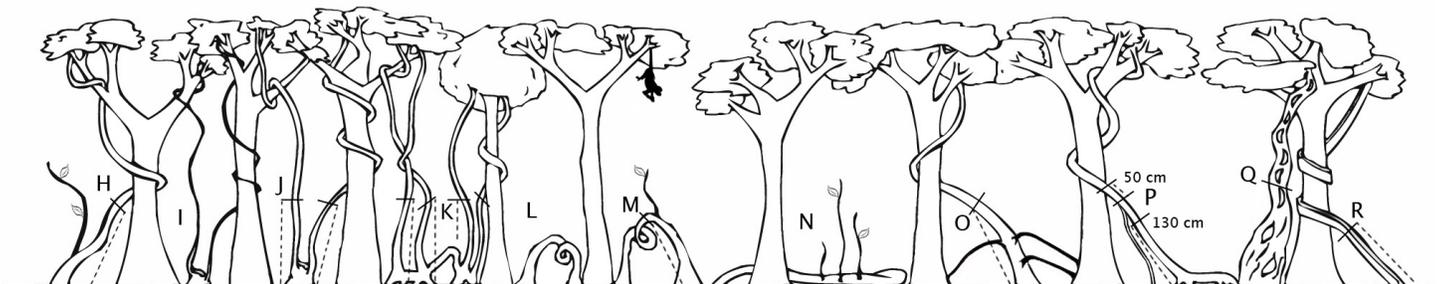


Illustration by S. Rutishauser

- H) Ignore branches < 1 cm diameter and measure the principle stem 130 cm from the roots.
- I) Exclude lianas that branch below 130 cm from the roots if none of the stems are ≥ 1 cm diameter 130 cm from the roots.
- J) If a liana branches within 40 cm of the roots, measure each stem (≥ 1 cm) 130 cm from the rooting point. Note that they are branches of a single individual and tag them as multiple stems (see below).
- K) Measure each resprout or branch (≥ 1 cm) 130 cm from the roots of each distinct rooting point.
- L) Exclude "ground-to-ground" lianas; those that do not ascend toward the canopy, but rather loop from one rooting spot to another or that are prostrate on the soil without any resprouts or branches, even if they are ≥ 1 cm diameter.
- M) Include "ground-to-ground" lianas if they have a resprout or branch, even if the branch is < 1 cm. If the branch is < 1 cm, measure the principle stem 130 cm from the roots, ignoring the branch. If the branch is ≥ 1 cm and within 130 cm of the roots, the point of measurement should be on the ascending branch.
- N) Exclude lianas growing prostrate along the soil if they do not have a stem ≥ 1 cm ascending towards the canopy.
- O) Exclude multiple branches that originate within 130 cm from the main roots if they are smaller than 1 cm in diameter.
- P) Measure 50 cm above the last adventitious root if that root is > 130 cm from the final rooting location of the stem before the stem ascends to the canopy.
- Q) If the stem is malformed from the roots to above 130 cm, measure stem where it becomes uniformly non-malformed.
- R) If the stem is flat and wide, include the liana if the mean of its wide and narrow axes are ≥ 1 cm.

Additional Measurement Considerations

STEM ANOMALIES, UNEVEN TERRAIN, AND ROOTING LOCATION

- 1) Measure 5 cm below stem anomalies (e.g., bulges, nodes, damage, or stem splitting). If the entire stem is deformed below 130 cm, measure stem where it becomes uniformly non-malformed (see case Q).
- 2) When measuring on a slope or uneven terrain, measure from the uphill side of the stem.
- 3) Include lianas that root in the plot only if the roots closest to where the stem ascends into the canopy are within the plot. If the last rooting point is outside of the plot, that liana should NOT be included.

DIAMETER MEASUREMENTS

- 1) Cylindrical (or nearly cylindrical) stems:
 - a. Stems < 5 cm diameter - use calipers at widest axis at the appropriate point of measurement.
 - b. Stems ≥ 5 cm diameter – use diameter tape.
 - c. If a stem > 5 cm w/calipers but < 5 cm with diameter tape, use diameter tape.
- 2) Non-cylindrical, flattened stems:
 - d. Measure diameters along their widest (d_1) and narrowest (d_2) axes at the appropriate point of measurement (e.g., 5.2 x 1.5). The average size of the two measurement must be ≥ 1 cm to include the liana in the census.

MULTIPLE-STEMMED AND ROOTED CLONES?

- 1) Measure and tag all independently rooted stems – soil excavation should be avoided at all times.
- 2) Multiple stems that are connected to the “principle” stem should be tagged with the same number as the principle stem followed by a letter, with each stem having a unique letter (e.g., 01-05-0353a, 01-05-0353b, 01-05-0353c, etc.). Multiple tags are not pre-printed; on the BCI plot we write the tag numbers on the 12-gauge green grafting tape that we use to tie the tags to the stems.

WHICH LIANAS TO INCLUDE?

- 1) All lianas (≥ 1 cm), including species with woody or fibrous perennial stems (e.g., *Desmoncus*, *Gnetum*, *Smilax*, *Dioscorea*)
- 2) Exclude epiphytes, hemi-epiphytes, and climbing bamboos (see Gerwing et al. 2006 and Troy et al. 1997 [cited in Gerwing et al. 2006] for treatment of bamboos).

TAG NUMBERING SYSTEM

- 1) Each tag has 8 digits (e.g., 01-05-0353). In this case, 01=the first census, 05=the column number, 0353=the unique liana number for that column.