

Best Practices Field Procedures for Height and Diameter Measurement

Forest Management Manuals & Guidelines

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1.0 RECOMMENDED FIELD EQUIPMENT PER CREW

- 1 –(10-50m) metric measuring tape (metal preferred) for hypsometer calibration.
- 2 – metal diameter tapes (metric) with millimetre graduations.
- 2 -- Telescoping metric measuring poles if trees are less than 6m in height.
- Tree height measuring device – hypsometer – (Vertex recommended) >6m trees.
- 4 – AA alkaline batteries for Vertex and Transponder.
- Vertex User Guide.
- GPS receiver to locate site – optional.
- Coloured flagging.
- Handheld Data collection computer or waterproof tally sheets.
- Charging cradle, backup batteries and power adapter for handheld computer.
- Measurement Software operating instructions.
- Waterproof bags to protect measurement instruments and tally sheets.
- Clip board.
- Establishment report and map of experimental trial.
- Quality Control assessment sheets.
- Tree Assessment Code sheets.
- Radio/Mobile phone.
- Digital Camera.
- Pencils and pens.
- Waterproof boots and outerwear to match weather conditions.
- Gate key to gain access to site.
- Rubbing alcohol to clean diameter tapes and telescoping measuring pole.
- 1.3 m stick for attaching Vertex Transponder for consistent measurement of DBH's when conducting measurements with an electronic hypsometer.

2.0 HEIGHT MEASUREMENT BY HYPSONETER

The Vertex III hypsometer is recommended for tree height measurements over 6m in height. This device was chosen because it's economical, light, portable, accurate, useable in closed stands and not as sensitive to user fatigue and operator variation.

2.1 Vertex Calibration

- **IMPORTANT** – the Vertex uses ultra sonic signals to determine distances. Humidity, air pressure, surrounding noise and most of all temperature can affect measurements. There is a built-in temperature sensor that automatically compensates for changes. For this reason calibration should be made regularly (Calibrate in AM and then again in PM if change of temperature is greater than 10 C).

- When calibrating, it is important that the Vertex has been given enough time to stabilize to the ambient temperature. If, for example, the Vertex is carried in an inner pocket, it can take up to 10 minutes before it has adjusted to current outdoor temperatures.
- **CALIBRATING** - measure a distance of 10.0 m between the transponder and the Vertex front with a tape. Start the Transponder and Vertex, step in the menu to **CALIBRATE** and press and hold **ON**. The Vertex will calibrate to 10.0 m and automatically turn off when ready.

2.2 Procedures for Height Measurements Using Vertex

1. Press the ON button to start Vertex.
2. Turn Vertex ON and arrow to SETUP, press ON, change setting to Metric, change to Type 2, P.offset should be 0.3 m, T.Height set at 1.3 m(DBH), M.distance set to 0.0.
3. Press both arrow keys simultaneously to shut Vertex OFF.
4. To turn the Transponder ON, keep the Vertex loudspeaker directly towards the transponder and press the left arrow key until two short signals are heard from the transponder (Vertex must be OFF).
5. Repeat above step; wait for four short signals to turn the unit OFF.
6. When taking height measurements the operator should be at least 25% further from the tree than the height of the tree (i.e. if measuring an 8 m tree the operator should be at least 10 m away from the tree).
7. Turn Vertex ON (Height should be displayed) and aim towards the transponder held at DBH (1.3 m). Press ON and hold until the cross hair sight is not visible. Now release ON. (The Vertex now has the distance, the angle and from this calculates the horizontal distance to the transponder).
8. Aim the transponder cross hairs (cross hairs should be blinking) at the vertical point on the tree to be measured (usually the tree top measurement point). Push ON until the cross hair disappears which indicates the vertical angle has now been locked in and the hypsometer uses the horizontal distance and vertical angle to calculate height. (Six heights can be taken per object but full tree height measurement only needs 1).
9. Turn Vertex OFF and then turn it ON ready for next tree.
10. For leaning trees that are between 5 to 20 degrees off of the vertical axis the measurement procedure should remain the same in order to attain a vertical measurement from the ground rather than a stem length measurement. These trees should get a “P” code. If lean is greater than 20 (21 to 90) degrees off of the vertical axis then no height should be taken and the tree should be given codes of “P” and “L” for a leaning and distinctly atypical tree.

2.3 Vertex Notes

- The red cross-hair light can be adjusted using the left arrow key when aiming.
- Horizontal distance can be taken by turning the transponder ON, aiming the Vertex at transponder (DBH) and pressing the DME (forward button).
- Check the Vertex daily and recalibrate if necessary (after it has reached ambient temperature).
- Do not touch the temperature sensor at the front of the instrument.
- 1.3 m is already added to Heights if T. Height is set to 1.3 m in SETUP.

- The transponder has to be “Hooked” onto tree with hook on the back of transponder or parallel to tree bole to get the correct horizontal distance for calculating tree height (use 1.3 m stick for correct DBH location).

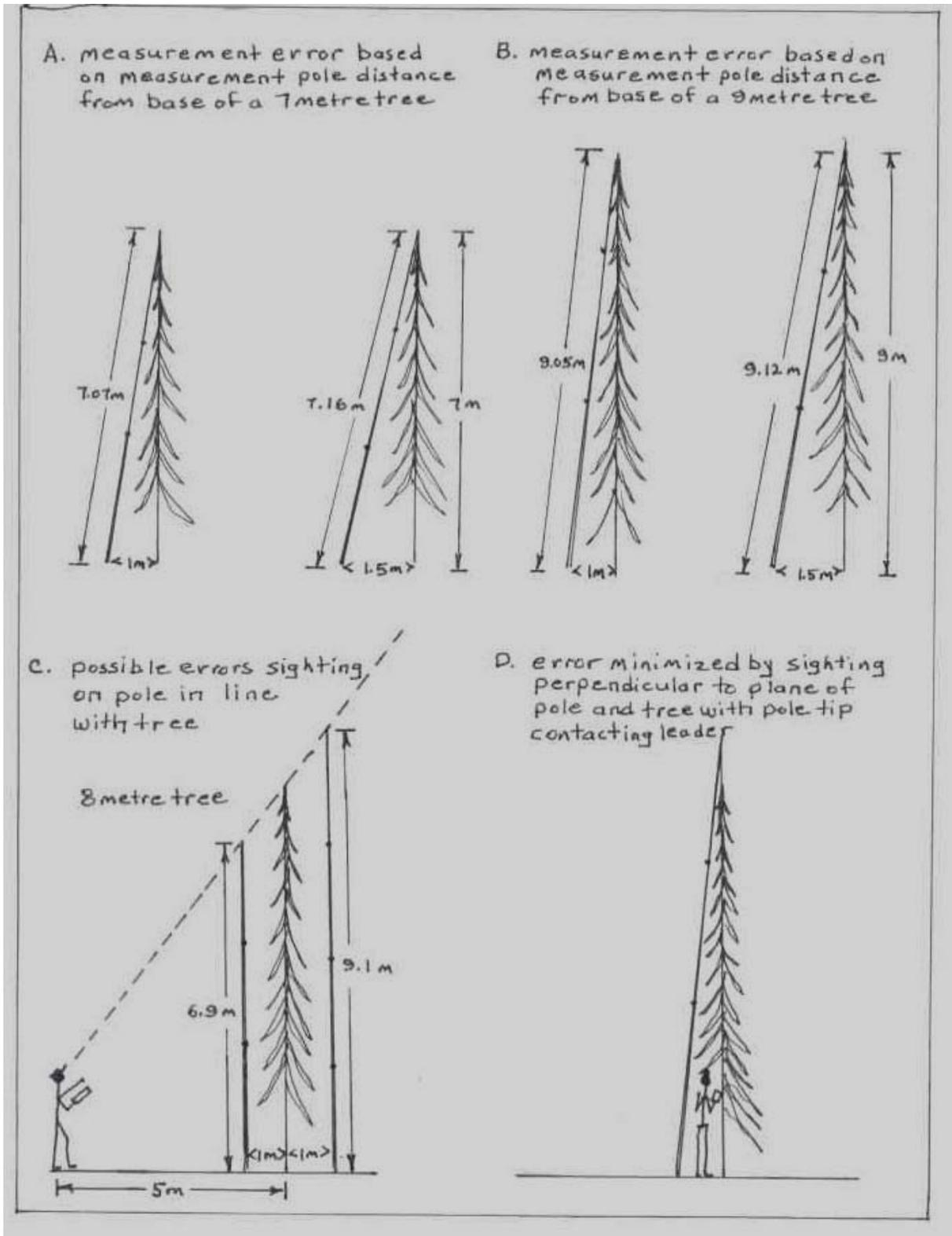
2.4 Trouble Shooting the Vertex

- When computing Heights, if the ON button is pressed once and released you are in manual distance mode. If this occurs, turn the Vertex OFF and then ON and follow #7 and #8 above.
- Refer to User Guide for Vertex and Transponder for additional information.

3.0 HEIGHT MEASUREMENT BY POLE

- Recommended maximum height of trees to be measured by pole is 6.0 m.
- Pole should be checked for accuracy at least twice a day and replaced if in question.
- Spotter should stand at least 90 degrees from the plane of the pole handler and tree.
- For leaning trees that are between 5 to 20 degrees off of the vertical axis the height pole should be held vertically (perpendicular to the ground) and the spotter should look along the plain from the top measurement point of the tree to the top of the height pole to obtain a height for the leaning tree (this provides a vertical height from ground rather than a stem length measurement). These trees should get a “P” code. If lean is greater than 20 (21 to 90) degrees off of the vertical axis then no height should be taken and the tree should be given codes of “P” and “L” for a leaning and distinctly atypical tree.
- Pole handlers are to maintain the pole as parallel and as close to the tree as possible. (May want to feed pole up through branches close to bole of tree and attach a bright color of flagging to the hook on top of pole for sighting purposes).
- Pole handler to insure that the base of the pole is at the same level as tree root collar. This is important on uneven ground.
- See below the most common sources of height errors using a pole for measurement.

3.1 Sources of Height Measurement Errors Using Height Pole



4.0 DIAMETER AT BREAST HEIGHT MEASUREMENT

- Measurement personnel assessing DBH height (1.3 m) and working with the hypsometer transponder where DBH is not marked on the tree should use a 1.3 m stick for locating DBH/transponder location which must be held right against the bole of the tree for exact location of DBH and measurement of horizontal distance by the transponder.
- All diameters at breast height are to be taken over the bark at 1.3 m above the germination point of tree.
- Metal diameter tapes are required because they deform less (by hauling or by temperature) than those of synthetic material.
- Insure that the correct side of the DBH tape is read.
- Diameter to be measured to the closest tenth of a centimetre and recorded in cm.
- Tape must be correctly positioned at the point of measurement (1.3 m), ensuring that it is kept in a perpendicular plane to the axis of the stem, that it is set firmly around the tree trunk with no obstructions present underneath.
- If a tree whorl, deformity, distortion, or branches are present or a fork occurs just below DBH (within 5 cm), the **cruiser must measure the diameter immediately above the irregular section** (see Fig. 7). **(Note in comments section how far up in centimeters from original DBH the new DBH location is)**. This is a source of major DBH measurement error and must be practiced consistently across every trial measurement.
- On sloping ground, DBH is to be measured from the uphill side facing down slope unless the point of germination is lower. See Figures 4 and 6.
- On trees where forking is present below DBH, measurement is taken on the tallest stem. See Fig. 3.
- On trees where forking starts at DBH, measure immediately below the origin of the fork. See Fig. 2.
- On fallen trees, DBH is to be taken at 1.3 m along the horizontal trunk of the tree from the point of germination. See Fig. 1.
- On trees which are leaning; DBH is to be taken on right angle to the center line of the tree. See Fig. 5.
- Rubbing alcohol should be used to clean the diameter tape of resin build-up.

4.1 Diagrams showing locations of DBH measurements

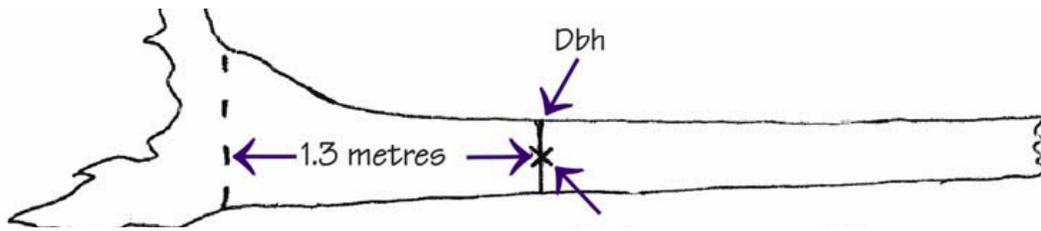


Fig. 1. DBH measurement location of a fallen living tree.

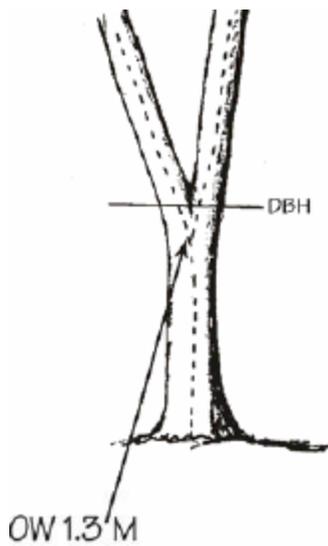


Fig. 2. Forking at DBH; measure directly below fork.

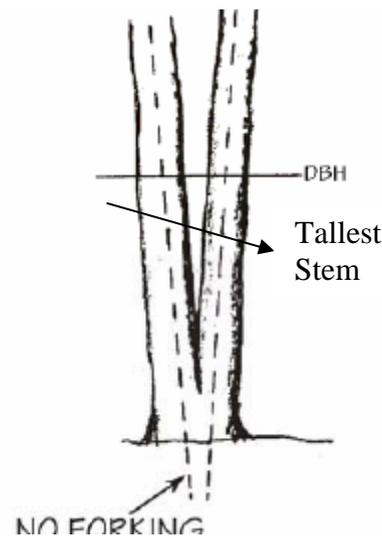


Fig. 3. Forking below DBH; measure tallest stem.

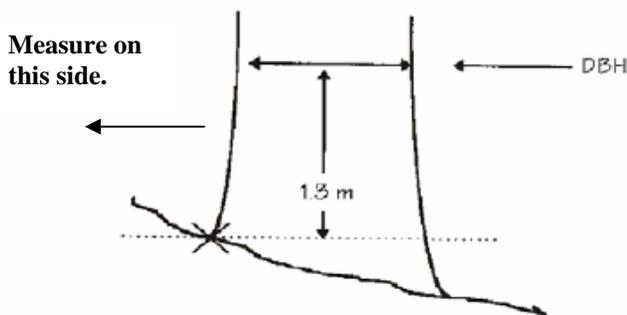


Fig. 4. DBH measurement on sloping ground, measure on up slope side of tree facing down slope.

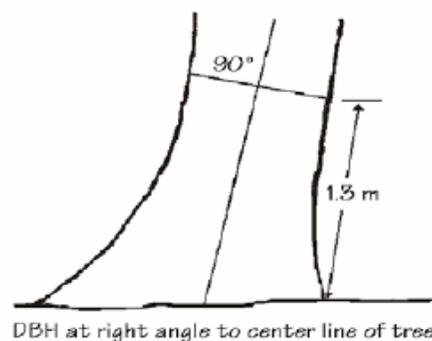


Fig. 5. DBH measurement on leaning trees; measure at right angles to centre line of tree.

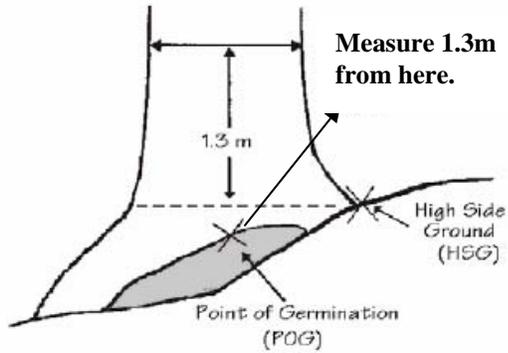


Fig. 6. DBH measurement on undulating and sloping ground where point of germination is lower than high side ground.

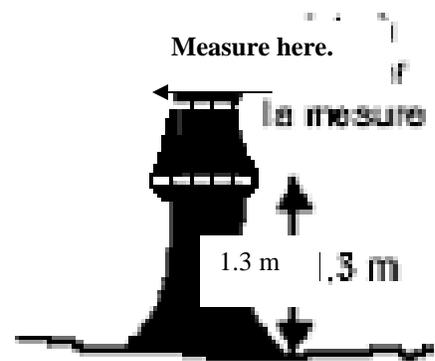


Fig. 7. Deformity at DBH; measure immediately above.

5.0 QUALITY CONTROL PROCEDURES FOR FIELD TRIAL MEASUREMENTS

This section under revision.