An Introduction to Measuring Plants and Trees for Appraisal Purposes

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Nursery Plant Size

- plant height

- diameter

- canopy size

- size of its container.

ALSO Trees Measured

- diameter and/or circumference of the trunk for valuation purposes.

- canopy size can aid the plant appraiser in determining the number of functionally equivalent replacement plants when employing the replacement.

- the diameter of a tree is measured to calculate the approximate cross-sectional area of a large tree trunk. We say "approximate" because the cross section of a tree is almost never a perfect circle.

Height

Plant height is a very useful measurement of plant size where plants provide screening, are being grown for timber, or are sold by height (e.g., shrubs, palms, or Christmas trees). Figure 4-1 shows how the height of palms is measured. The appraiser can collect height data using a clinometer, laser range finder, tap, or rod.
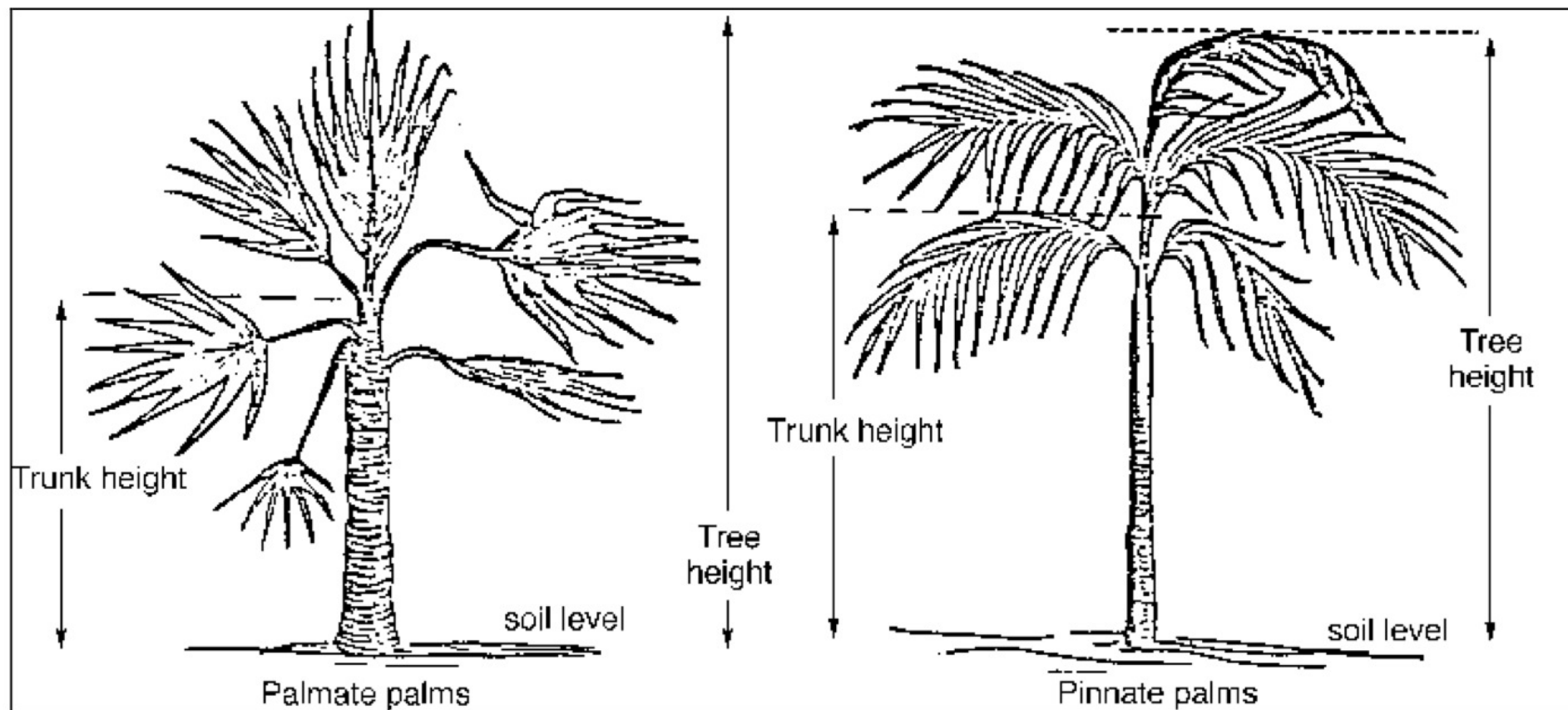

Figure 4-1. Palm trunk height is measured from grade to the base of the spear leaf (from ANSI Z60.1 2004[13])

Trunk Diameter/Cross-Sectional Area

• To estimate the "cross-sectional area" of a tree trunk, the cross section is usually considered to be a circle. The trunk area is generally calculated by measuring the circumference or the diameter of the trunk.

• The two most common instruments for these measurements are _diameter tapes and calipers_. Forget the caliper if you want to be more precise. Why?

• The area of a circle can be calculated by using either its radius (r), diameter (d), or circumference (c), and pi (π) as noted in the table below.

Formulas for calculating the area of a circle:

• $d = c \div \pi$
• $r = d \div 2$
• Area $= \pi r^2 \approx 3.14 r^2$ or $0.785 d^2$

FORGET THESE FORMULAS ABOVE!

• MEMORIZE THIS: _diameter x diameter x .785 = area_

- Canopy size is useful in determining numbers of replacement plants in Replacement Method or Cost of Cure Method.

- The height at which a tree is measured depends on size.

- The American Standards for Nursery Stock specifies measurements to be taken at 6 inches from the ground for trunk diameter up to and including 4 inches.
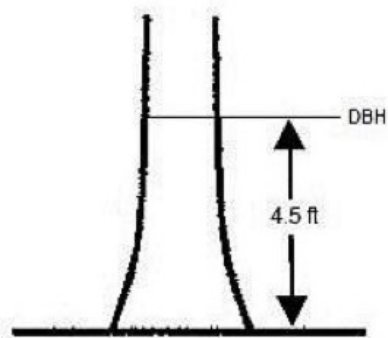
- Larger trees assumed to be of transplantable size are measured at 12 inches.

- Trees considered too large to transplant are measured at 4.5 ft.

- Cross sectional trunk area is determined to give a more realistic representation of size and value for large trees.

- For trees larger than 30 inch diameter the trunk area is converted to the Adjusted Trunk Area (ATA).

- ATA is used to account for a rate-of-tree-value increase being less than its rate of increase in trunk area. Huh?

- ATA is based on the premise that a large mature tree would not increase in value as rapidly as its trunk area would increase. Dr. Richard Harris employed a mathematician at UC Davis to create a conversion chart. *See page 30 of the Guide.*
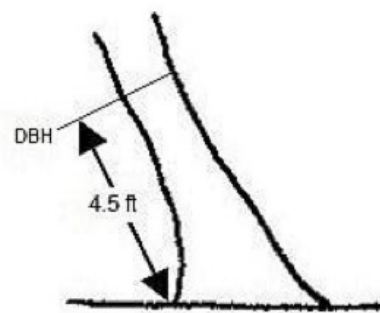
- Formula for ATA = is complicated to remember (page 44). Just use the chart on page 30 to avoid potential calculation errors.

- Elliptical Cross Section can be useful because few cross sections are a circle.

- The farther a cross section deviates from a circle, the smaller the area will be for a given circumference. If the trunk is obviously elliptical (oval) a different formula may result in a more accurate determination of trunk area.

- Elliptical Area = 0.785 x largest diameter x smallest diameter as opposed to diameter squared x 0.785 for more circular trunks.
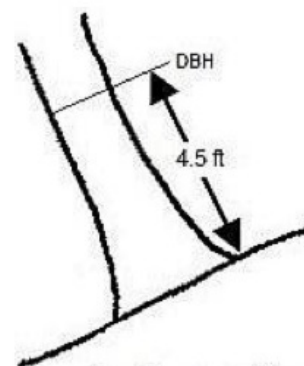
- Current guidance requires DBH measurement starting at the center of the trunk going upwards to 4.5 feet.

- The photographs in the next slide are proposed new measurements that may be approved for the 10th edition Guide for Plant Appraisal based on forestry measurements.

- For now use the 9th Edition guidance for measuring DBH especially the centerline of the trunk going upwards on leaning trees and trees on a slope. Ignore the following photographs on the next slide. The may be included in the near future.
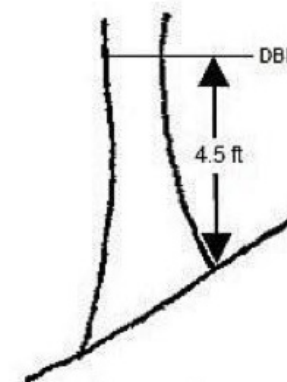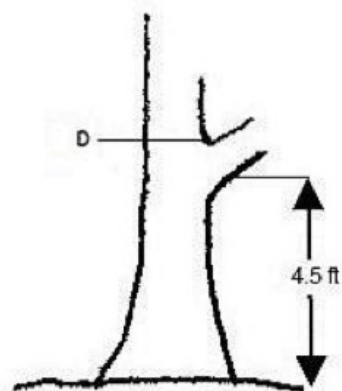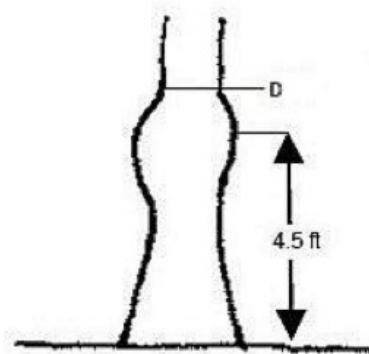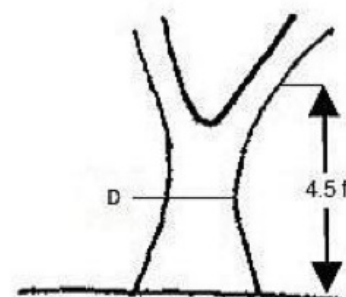
Level Ground

Leaning Tree

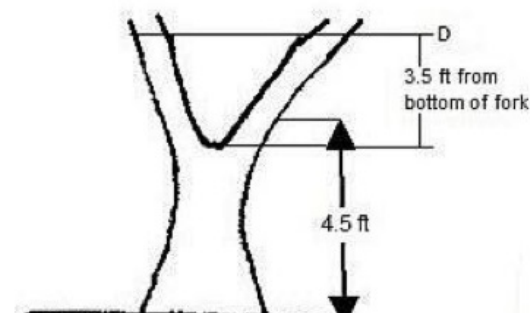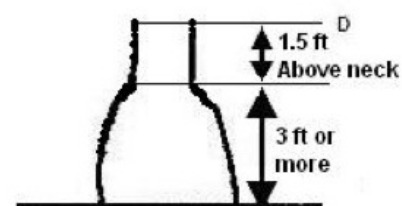Leaning Tree on Slope

Tree on Slope

Branch at 4.5 ft

Swell at 4.5 ft

Forked below 4.5 ft
(most cases)

Forked below 4.5 ft
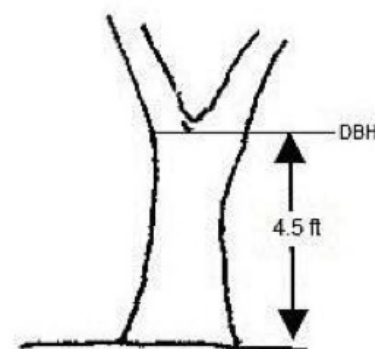(timber)

Bottle Butt (Bottleneck)

Windthrown

Forked above 4.5 ft
(timber)

Multiple Stems

Multiple Stem Trees Can be Tricky to Measure or Not

Why?

- Require considerable judgement in deciding how to measure each stem and estimate its contribution to the total tree

How?

- Method 1: If a multi stem tree of similar transplantable size is available use the Replacement Cost Method

- Method 2: if all the stems arise from or within 3 ft. of the ground and each stem contributes equally to the canopy then determine the cross sectional areas of each stem measured at 4.5 ft (DBH) from its base.

- Remember the formula for cross sectional area yet? Memorize it!

- Diameter squared x 0.785

What Ifs?

- Different stem configurations may require measuring at other heights or locations. Remember slide 11?

- What if I do not remember how I measured it? Simple, take field notes and save them if questioned.

- What if one stem does not contribute to overall canopy size? Simple, do not measure it. Take notes.

Table 4-2: Calculating the trunk area for a tree with multiple stems

Stem	Trunk area calculation	Trunk area
1	$0.785 \times (3 \text{ inch})^2$	7.085 inch^2
2	$0.785 \times (5 \text{ inch})^2$	19.625 inch^2
3	$0.785 \times (3 \text{ inch})^2$	7.085 inch^2
4	$0.785 \times (3 \text{ inch})^2$	7.085 inch^2
5	$0.785 \times (3 \text{ inch})^2$	7.085 inch^2
	Sum of Stems 1-5	47.88 inch^2

Examples
Adjustments
Method 3:

- What If a stem has a cross sectional area that is 25% of the sum of all stems yet only contributes to 15% of the crown volume?

- Adjust by multiplying 0.6 (15% by 25= 60% or 0.6)

- Usually the largest stem will be given full value (100%) for its cross sectional trunk area.

- Remember the formula for cross sectional trunk area?

Method 4: A Test of Reasonableness

- Are my measurements reasonable?

- Determine the size of adjacent single stem trees of similar size. Compare. This is the best test.

- Caution: do not add all diameters together. Determine diameters and convert to cross sectional trunk area and then add them appropriately.

Trees Cut Off Below 4.5 ft

- Precision is not possible.

- A reasonable approximate should be acceptable.

- US Forest Service provides tables of species diameters yet is not accurate for ALSO trees.

- If similar species are growing nearby with similar growing conditions diameter can be estimated with "reasonable" accuracy. The more trees nearby the closer your estimation will be.

When Accuracy Matters

- The more similar trees to measure the more accurate.

- Using complex methods such as ratio analysis, regression analysis, crown volume are not commonly applied by ALSO tree appraisers.

- The tools are available to estimate predicted trunk diameter and loss of crown volume. In some cases you may find a need for assistance.

Potential Problems

- Do not rely solely on regional price lists. They can be outdated.

- Largest commonly available tree is not always what is in the current published species group classification index (green book).

- Try appraising the same tree with the same depreciation factors across regions to see the difference a container size results in determining final TFM value. You will be amazed.

- Installed, wholesale, and retail prices of container sizes will have a high impact on final opinion of value. Try to be consistent.

- Learn concepts not just methods to improve your understanding of the tree appraisal process.

- Continued education and staying on top of changes is a must.

Take Home Message

- Refer to your Guide each and every assignment.

- Do not expect to remember every thing.

- Take on assignments with an experienced partner to get the feel of the process.

- Do not let your client influence your decisions.. Work independently, objectively, with freedom of bias.