MISSISSIPPI STATE UNIVERSITY EXTENSION

Using the MSU Basal Area Angle Gauge

Basal area (BA) is commonly used by foresters as a simple and easily measured estimate of the density of a stand of trees. BA is simply a measure of the cross-sectional area of a stand of trees at 4.5 feet aboveground and is expressed in square feet per acre (square feet per acre). In other words, think of BA in the context of slicing all trees on a given acre at 4.5 feet above the ground, then adding the cumulative area of diameters at the point where all trees were cut.

This is the procedure for calculating BA for an individual tree:

Basal area (BA) = $0.005454 \times DBH^2$
(DBH = diameter at breast height, or 4.5 feet above the ground)

To determine basal area on a per-acre basis, you can use an angle gauge of a known basal area factor (BAF). Using a known BAF, each tree measuring *in* on the angle gauge counts as one multiple of a predetermined BA. For example, using a BAF 10 angle gauge results in each *in* tree representing one multiple of 10 square feet per acre of BA. This provides a fast and simple method of BA estimation for foresters and other land managers.

BA estimation on a per-acre basis follows this simple method:

Basal area/ac (BA_{ac}) = (number of *in* trees) × (BAF)

Measured BA can be used as a trigger by forest managers in making the decision for thinning a stand of trees. For example, when BA of a pine plantation reaches 120 square feet per acre, foresters know that it is time for a thinning. Mangers can also use target BA as a guide for how many residual trees to leave in thinning operations. For example, many foresters desire to leave a residual post-thinning BA of 70–90 square feet per acre, and wildlife biologists may want a less dense stand with a BA of 40–60 square feet per acre. The angle gauge is the simplest of several tools available to measure BA. If used properly, the instrument can give relatively precise estimates of BA.

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The MSU Basal Area Angle Gauge can be used to obtain BA estimates quickly. Be sure to extend the angle gauge the correct distance, and evaluate trees carefully to avoid incorrect estimations of BA. This is the correct procedure for using the MSU Basal Area Angle Gauge:

1. Extend the angle gauge 25 inches from your eye. To maintain the correct distance, measure string or twine and tie it to the angle gauge (Figure 1). Keep your eye at a central point and extend the angle gauge from that point. One commonly used technique is to place a staff or stick at the center point of your measurement plot, and extend the angle gauge from that point.

Figure 1. Using the MSU Basal Area Angle Gauge at 25 inches from the eye. Photo by Stephen Dicke.

2. Mark your first tree and pivot clockwise, evaluating each tree individually. Look at each tree at 4.5 feet above ground level and assess the *in* status using the angle gauge. Decide whether each tree is *in*, *out*, or *borderline* (Figure 2). Each *in* tree counts as 1 unit of the BAF of your angle gauge (BAF of 10 using the MSU Basal Area Angle Gauge), and each *borderline* tree counts as half of a unit.

   in tree = diameter of tree at 4.5 feet appears larger than the box width on the angle gauge
   out tree = diameter of tree at 4.5 feet appears smaller than the box width on the angle gauge
   borderline tree = diameter of tree at 4.5 feet appears exactly the same width as the box on the angle gauge

3. Once you have pivoted back to your initial measurement tree (take care not to overlap), add your *in* and *borderline* tree count together and multiply the sum by 10 (the BAF of the angle gauge). For example, if 11.5 trees were counted, you would multiply 11.5 by 10 for a BA of 115 square feet per acre. Multiple BA counts should be averaged throughout a timber stand to obtain a good estimate of stand BA. At this point, the BA estimate can be used in management decision-making processes.

If you would like an MSU Basal Area Angle Gauge, please contact your local MSU Extension Forestry specialist or local county Extension office.

Figure 2. Counting trees using the MSU Basal Area Angle Gauge. Photo by James Floyd.

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