

# Accredited Timber Cruiser/Evaluator Examination – Study Guide



Most of the common calculations that cruisers utilize are forgotten, or in most cases overshadowed by handy tables or computer calculations. This simple Study Guide is intended to refresh your memory on 'how to' and 'when to'... the old fashioned way, starting with the basics:

**What is Standard Deviation (SD)?** It is quite simply the *square root of the variance* of individual values from the population mean (expressed in whatever units of measure you are using i.e. m<sup>3</sup>, number of stems, heights etc.)

**What is Coefficient of Variation (CV)?** CV is the term used when the SD is expressed as a percent of the mean. In other words, the CV is the ratio of the standard deviation to the mean calculated as:

$$CV = \frac{SD}{\bar{0}}$$

SD = standard deviation

$\bar{0}$  = the mean

Let's say the mean of your samples is 133 (m<sup>3</sup>) and your SD is 73 (m<sup>3</sup>) then the CV will be 0.5488 or 55%.

## Fixed Area Plots

To determine the area, in hectares, for a fixed area plot [say 3.99m radius] the calculation is:

$$\frac{\pi R^2}{10,000} = A$$

R = Radius

$\pi$  = 3.14159

A = Area

$$3.14159 \times (3.99 \times 3.99) = 50.014$$

then

$$50.014 / 10,000 = \underline{0.005 \text{ ha.}} \text{ or } 1 \text{ ha} / 0.005 = \underline{1:200 \text{ of a ha.}}$$

## Plot Radius Factors

The Plot Radius Factor (PRF) is the ratio of Distance/DBH. Therefore, if your visibility is limited to 14.1 meters Distance and a tree is 80 cm DBH then the PRF for that tree is calculated as:

D = Distance (m)

DBH = Diameter Breast Height (cm)

$$\frac{D}{DBH} = PRF$$

$$14.14 / 80 = 0.17675 \text{ [rounded to 0.1768]}$$

This just happens to be the exact PRF for BAF 8.0

To calculate the plot radius (PR) [or in/out critical distance] for the above tree, the formula is:

$$PRF \times DBH = PR$$

$$0.1768 \times 80 \text{ cm} = 14.14 \text{ m}$$

## Basal Area Factors

The Basal Area Factor (BAF) indicates m<sup>2</sup>/Hectare. For an example, a single tree [regardless of size] tallied using a BAF 8.0 prism will represent 8 m<sup>2</sup>/Hectare.

To determine the PRF of a BAF 8.0 prism, the formula is:

$$\frac{1}{2\sqrt{BAF}} = PRF$$

$$1 / (\sqrt{8} \times 2) = 0.17677 \text{ [rounded to 0.1768]}$$

Therefore the plot radius for a 60 cm tree with a BAF 8.0 prism is:

$$DBH \times PRF = PR$$

$$60 \text{ cm} \times 0.1768 = 10.608 \text{ [rounded to 10.61 m]}$$

## Trees per Hectare

To determine how many Trees Per Hectare (TPH) the one 80 cm tree represents, the following formulas apply:

R = Plot Radius (PR)

$\pi$  = 3.14159

A = Area

$$\frac{\pi R^2}{10,000} = A$$

$$3.14159 \times (14.14^2) = 628.1\text{m}^2$$

then

$$628.1 / 10,000 = 0.0628\text{ha.}$$

$$\frac{1.0}{A} = \text{TPH}$$

$$1.0 / 0.0628 = 15.92$$

This calculation shows that the one tallied tree represents 15.92 trees per hectare.

## Calculating 'n' [number of samples required] for Prism Sampling

t = probability factor of 0.05 (or 95%)

CV = coefficient of variation (we will assume 38%)

E = error objective in percent (we will assume 12%)

$$n = \frac{t^2 \times CV^2}{E^2}$$

Let's assume that you are going to establish approximately 40 samples therefore,

$$t = 2.021, CV = 38 \text{ and } E = 12 \text{ and:}$$

$$[(2.021 \times 2.021) \times (38 \times 38)] / (12 \times 12) = n$$

or

$$(4.084 \times 1444) / 144 = 40.953 \text{ or } 41 \text{ samples rounding up.}$$

*Note: always plan to establish an additional 10% therefore, n = 45 samples*

## Calculating Slope Distance Factors

Slope = 48%

Slope Distance = 23.0 m

$$\text{COS} [\text{TAN}^{-1} \left( \frac{48}{100} \right) ] = 0.9015$$

Start with 0.48, press TAN<sup>-1</sup> then COS.

To obtain Horizontal Distance from a Slope Distance - you have measured 23.0 meters on a slope of 48% and want to find out what the horizontal distance is:

23.0 m × 0.9015 = 20.73 m horizontal distance.

To obtain Slope Correction for a Horizontal Distance - again you have measured 23.0 meters on a slope of 48% and want to find out what the slope correction is:

23.0 m / 0.9015 = 25.51 m slope distance.

The following is a brief description of other types of ATC and ATE questions that may be asked:

- a) Variable Plot Cruising
  - i. In/Out tree calculations
  - ii. Represented volume per hectare
  - iii. Critical distance around boundaries
- b) Statistics and potential bias
  - i. Sampling error
  - ii. Calculating number of samples
  - iii. Achieving SE objectives
- c) Appraisal cruising in BC
  - i. Risk groups
  - ii. Tree classes
  - iii. Compilations
  - iv. Plot location
  - v. Pathological indicators
  - vi. Loss factors
  - vii. Grade and net factors (coastal)
  - viii. Check cruising

- d) Cruising in general
  - i. Cruising private land
  - ii. Correct volume, heights and value
  - iii. Combining sampling errors
  - iv. Declination
  - v. Alternate cruising methodology
- e) Cruiser Ethics

The following is a brief description of other types of ATE questions that may be asked.

- a) Cruising in general
  - i. Plot establishment
  - ii. Sampling methodology
  - iii. Sampling accuracy
  - iv. Quality control
- b) Cruise Plans
  - i. Plot optimization
  - ii. Sampling plan designs
  - iii. Cruise plan amendments
- c) Cruise Compilations
  - i. Reduction compilations
  - ii. Compilation types
  - iii. Specifications and procedures