Station 5

BigBAF Cruising

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CASE 1: Sub-Boreal Spruce, Fort St. James Forest District

$Pl_{82}Sx_{15}At_3$		$215m^3/ha$	
153 measure plots	719 measure trees	BAF 7	4.7trees/plot
Basal Area CV: 45.6%		VBAR[a] CV: 23.1%	

Target SE for <u>each</u> parameter[b]: 10.0%

Sample size needed for Basal Area

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

$$n = \frac{1.98^2 \times 45.6^2}{10^2}$$

$$n = 82$$

You need 82 plots to sample Basal Area to a 10% Sampling Error.

Sample size needed for VBAR

$$n = \frac{1.98^2 \times 23.1^2}{10^2}$$

$$n = 21$$

You need 21 measure trees to sample VBAR to a 10% Sampling Error.

Why would you measure 385 OR EIGHTIEEN TIMES MORE trees than you NEED to??
(82 plots x 4.7trees/plot = 385 trees)

Solutions

<u>Count Plots</u>

In this case, we could measure as few as one plot out of every 18 plots we tally (i.e. 1:17 measure to count ratio)

The difficulty with this approach is that the distribution of measure trees across the sample population is not very good (clumpy), and with doing so few measure plots, we may forget (how) to do a measure plot!

<u>BigBAF</u>

In this case, the BAF we use to choose the measure trees could be (about) 18 times bigger than the BAF we use to choose the trees to tally (count).

The advantage of the approach is that the measure trees are well (evenly) distributed across the sample population, and the mechanics of each and every plot is the same (whether or not you actually select a measure tree), so the risk of forgetting to do measurements is greatly reduced.

BigBAF Field Procedure

- Establish plot centre (like you normally do)
- Do a prism sweep with the "Small" BAF and tally each tree's species (like you normally do)
- Do a prism sweep with the Big BAF to select your measure tree(s)
- Measure (like you normally do) ONLY the tree(s) selected with the Big BAF
- Enjoy an extra long lunch because you just saved yourself a quarter of the effort you usually expend

<u>Footnotes</u>

a VBAR: "**V**ariable of interest" (in this case net volume) to **B**asal **A**rea **R**atio. If the ratio of the variable to basal area is very consistent (which is the case with volume), then you need only a few trees to sample that relationship.

b Bruce's formula for combining SE is $(SE_1^2 + SE_2^2)^{\frac{1}{2}}$; therefore, $(SE_{BA}^2 + SE_{VBAR}^2)^{\frac{1}{2}} = (10^2 + 10^2)^{\frac{1}{2}} = 14.14\%$, which would meet the 15% Sampling Error requirement of appraisal cruises

Some things to consider...

- While it is preferable to keep the target SE for each parameter roughly balanced, you can skew them to achieve a more practical measure-to-tally ratio. Considerations for the ratio to select include the likelihood of selecting rare species for measurement, variability of the "variables of interest," and available BAF angle gauges (good luck finding a 126BAF prism). To select for measurement one out of X trees, just use a BAF that is X times bigger than the one you use to tally the trees (e.g. 1 in 4 trees, use 20 Big BAF and 5 Small BAF).
- Rare & Orphan Species: At least one sample tree by species <u>by type</u> is required for the BigBAF calculations, therefore it is imperative that you pay attention to the species that you tally (i.e. count with the Small BAF). The best procedure is to measure (regardless of whether you pick it up with the Big BAF) the first tree of each species that you encounter in <u>each type</u>, That way, you can be sure to not walk out of the bush missing information.
- Watch out for variables that are not compiled using Basal Area. For example, snags are reported as stems/ha, and have no volume associated with them. Therefore, you have to identify every Tree Class 4 tree that you <u>tally</u> (and measure its DBH for the stems/ha calculation). If you do not do this, the compilation will assign volume to each tallied Tree Class 4 that is not so identified.
- For figuring out the ratio of count to measure plot when using measure plots, a great tool is Kim Iles' StarBAR program (available at http://www.proaxis.com/~johnbell/), especially to help take into account the cost differences between count plots and measure plots. This program can also be used to help select Big and Small BAF sizes.

Some useful formulas

To combine Sampling Errors

$$SE\%_{combined} = (SE_{BA}{}^2 + SE_{VBAR}{}^2)^{1/2}$$

To combine Basal Area Factors

$$BAF_{combined} = (BAF_1{}^{1/2} + BAF_2{}^{1/2})^2$$

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For you cynics, who will insist that this won't work in "your" forest, here is another example...

<u>CASE 2</u>: Interior Cedar-Hemlock, Arrow Forest District

$H_{46}C_{32}Fd_{13}B_3Pw_2S_2Ep_2Act_1$ (is that diverse enough for you?) $515m^3/ha$

248 measure plots	1416 measure trees	BAF 7, 8, 9, 12, 14	5.7trees/plot
Basal Area CV: 46.9%		VBAR CV: 28.7%	
Target SE for <u>each</u> parameter: 10.0%			

Sample size needed for Basal Area

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

$$n = \frac{1.98^2 \times 46.9^2}{10^2}$$

$$n = 87$$

You need 87 plots to sample Basal Area
to a 10% Sampling Error.

Sample size needed for VBAR

$$n = \frac{1.98^2 \times 28.7^2}{10^2}$$

$$n = 33$$

You need 33 measure trees to sample
VBAR to a 10% Sampling Error.

You need ore plots than Case 1 because the Basal Area is more variable, and more trees than Case 1 because the VBAR is more variable.

But still...

Why would you measure 496 OR FIFTEEN TIMES MORE trees than you NEED to??
(87 plots x 5.7trees/plot = 496 trees)

<u>References</u>

Iles, K. 2003. A sampler of inventory topics: a practical discussion for resource samplers, concentrating on forest