The Nun goes cruising ~

In which …

The Nun gets an orientation to Variable Plot Sampling,

and to distributing measurements throughout the stand.

Vi realized that to have more affect on the way things were done in the company she really should know the jargon and something about the field procedures. Although she had encountered only a few actual numbers in her University classes (Dr. Smiley used mostly symbols, which he claimed were more universal) she knew that they mattered – at least to some folks. This would also give her the chance to impress the field people.

Her request to "visit the field and have some useful dialogue with the cruising staff" was treated as an opportunity by the inventory department. Ray and Bob (two expert cruisers) picked her up in the morning and drove her up to the forest - knowing that they would lose some production in order to plant a few ideas in what they hoped would be a receptive mind. They made sure she had the right safety equipment, and provided a pair of boots in her size. Mike, the field crew supervisor was already on site and helped occupy The Nun so she did not terminally annoy the cruisers.

"I notice that you put these sample plots in systematically", said The Nun, "even though Sampling Theory is based on the random location of samples. I suppose I can live with that", she said - with what she thought was her most gracious tone of voice.

"Yes", replied Mike, "we use a grid. Sampling theory is *not*, of course, dependent on random location of plots, Vi. There is plenty of theory about sampling from grids – they are just instances of cluster samples. If we need to do so, we know the proper techniques for evaluating variance in

systematic samples. We don't care much about the exact Sampling Error, but we do care about getting the better average that systematic samples give us. The fact that the Sampling Error of a systematic sample is virtually certain to be smaller than a random sample is nice, of course. Both the practical and the theoretical advantages of sampling on a grid appeal to us."

The Nun was a bit disturbed by this. She had not expected the unwashed to know much about sampling theory, and she had been caught in a mistake in the first few minutes. She knew she could do better. Wisely, she shut her mouth and observed for the next few plots. Mike made sure she had a chance to use every instrument enough to understand the trigonometry and the recording processes for the data. He had also done that with the company computer programmers he invited out during the previous week. At break time, Vi decided to discuss a few of the theoretical issues.

"Why do you always count the trees at DBH ?", she inquired. "Just tradition", answered Mike. "We could actually do that at any level. The only important thing is that the point where you are sighting the tree matches the point where you measure basal area to compute VBAR. DBH is just used as a convenient standard. When we get a tree that looks 'borderline' with the Relaskop angle we measure it to make sure. The Relaskop seems to have fewer 'borderlines' than prisms did. Some companies have a process for checking borderline decisions on a sample basis, rather than checking every borderline tree – but we prefer to check them in every instance. We would not do that for *our work*, but when we deal with other companies the borderline checks make them comfortable."

"I suppose a borderline tree can make a lot of difference to the stand volume ?", suggested The Nun. "No", replied Mike, "it makes a lot of difference to stand *basal area*, which *in turn* makes a difference to many other stand measurements. There are techniques to make borderline trees very much less important, but at present we are not using them except on permanent sample plots. We are using fairly traditional compilation techniques – but fairly modern sample tree *selection* techniques."

"I notice that you are measuring trees with two different BAF angles", she said.

"No, we are <u>counting</u> trees with one of the angles to get stand basal area, and <u>selecting</u> measured trees with the other angle. Those measured trees will provide the conversion from basal area to other units. Those processes *could* be done by separate crews, on separate plots, and for that matter by different sampling methods. We just happen to do them at the same time for convenience and efficiency. Counting requires only diligence, while measuring requires skill and experience. In this case, both of these cruisers are superbly competent, but we could use an inexpensive

and less skillful compassman (to do the tree counts) teamed up with a more expensive cruiser (to do the critical tree measurements)."

"We use a Relaskop for counting trees because of its slope correction. The counting process is easy to teach and simple to do, but must be done accurately. Every counted tree out here represents the same basal area. The basal area represented is the 'BAF' of the angle. The units are square feet per acre or square meters per hectare. Some of the older cruisers prefer to use prisms rather than the Relaskop. If so, they carry several prisms, and we make sure they are different shapes, colors or sizes so they do not grab the wrong one by mistake. We could use different counting angles on different plots, but choose not to do so for quality control reasons. A person gets used to looking out to certain maximum distances, using the same colored bars, etc., so a consistent angle helps the quality of the work."

"The measurements are a different matter. Take tree value, for instance. The measured trees will determine a value for each log, and total them for the tree. That tree value will then be divided by the tree basal area (in ft^2, for instance). **We now have the dollars per square foot for that measured tree**. Several trees are averaged, of course, but we now have an expensive process (requiring talent) that provides the conversion from stand basal area into dollars. We do the same for any other units of interest. Right now there is an interest in tons of material, so the measured trees also provide tons/ft^2. OH has arranged for our computer people to calculate statistics for each of these ratios that the sample trees give us".

"What if the log values, measurement units or tree volume equations change with time ?", asked Vi.

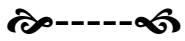
"We simply recompile", replied Mike. "The averages might change, but the relative statistics like Sampling Error **%** are always virtually the same even with compilation changes. We keep the data in a database just in case we want to process it differently at a later date."

"If we want to select 1 tree out of 4, we just use a BAF 4 times larger to choose sample trees. There are other ways we actually prefer to select trees, and we only use the second BAF angle because it is easy for the check cruiser to verify the selection. It doesn't matter much if a few selection mistakes are made, because if we missed a tree or included an extra one the difference in the average is really quite trivial – but you know how Check Cruisers from outside your own organization can be. The hand-held data recorder could select a random tree from the counted ones, or we could measure all the trees on 1/4 of the plot (a 90 degree sweep). Just as a rough check, we compare the percentage chosen over time, by tree size, as a quality control check. Sure enough, it's 1/4 of them - just as it should be."

"I am more familiar with the process of measuring all the trees on every 3d or 4th plot", said the Nun. This actually meant that she had once read a paper where this was done. "We formerly did that", said Mike, "but it was far less efficient and made people nervous because of long distances between measurement groups. Distributing the VBAR trees, with a few trees per sample point, gives about twice the efficiency of measuring them in clumps. It also balances the work load more evenly for the crew".

"How can I get a rough estimate of the volume in stands ?", asked The Nun - just in case she had to bluff her way through a field trip with other statisticians. "Easy", said Mike. "Your thumb is about a 15 BAF (in square feet per acre). Count the trees bigger than your thumb. Let's say you get an average of 8 trees/point (8*15 = 120 ft^2/acre). These trees are close enough to a cone, so the VBAR (cubic feet per square foot of tree at DBH) is about 1/3 of the tree height. With 90 foot trees, the VBAR is therefore 30 cubic feet per square foot. Multiply basal area per acre (120 ft^2) times VBAR (30 cubic feet/ft^2) and you get 3,600 cubic feet per acre. Close enough for many rough planning purposes. If you want the statistics, do those with your tree count and tree height as substitutes for the CV of basal area per acre and the CV of VBAR." Just about any conversion ratio for volume units will be some simple proportion of tree height".

"It's quite simple, really", said Mike, but The Nun knew instinctively that she was observing a wealth of skill and experience here.



Back at the office, The Nun more exactly calibrated her thumb with a section of the STAR_BAR program (also found in the CD included with this book). She also took a look at the VBAR values of individual trees. She compared these with the tree heights, and found that 35% was a better estimate of VBAR compared to tree height. She also noted that one species was a bit of an outlier, at 40%, and slipped that observation into a conversation at the cruiser's coffee pot one day. The cruisers were suitably impressed that she had been listening, and told OH that she would be welcome to come out again some time in the future.

Note to readers ... the next chapter is about equipment issues, especially historic equipment.