FOREST INVENTORY AND BIOMETRY

Class:- B.Sc (Forestry) IVth year

Course Teacher :- Dr Kundan Singh

LECTURE 4. KIND OF SAMPLING - RANDOM AND NON-RANDOM SAMPLING

KINDS OF SAMPLING

There are two main kinds of sampling used in forest inventories:

(A) Random sampling and (B) Non-random-sampling

(A) Random Sampling

Random sampling is that method of sampling in which sampling units comprising a sample are selected in such a manner that all possible units of the same size have equal chance of being chosen. In this method, sampling units are selected by using a table of random numbers, by unbiased drawing of card from a well-shuffled pack or by drawing lots. The following variations of this sampling method are used in forest inventories.

Unrestricted or simple random sampling – The unrestricted or simple random sampling is one in which sampling units comprising the sample are selected by some strictly random process form the whole population or area without dividing it into homogenous blocks. For example, if sampling unit is 0.1 ha, and the population area is 1000 ha the population is divided into 10,000 sampling units and each of them given a number 0000 to 9999. Now for a 5% unrestricted random sampling, 500 different four digit reference number are selected by using a table of random numbers. In this way, every possible set of 500 units has equal chance of being chosen for the sample.

Stratified random sampling – The stratified random sampling is that method of sampling in which the population is first divided into subpopulations of different strata and then sampling units are selected from each of them in proportion to their size. This modification in the simple random sampling is necessary because the method of unrestricted random sampling gives good results only if the forest crop is uniform but generally forest populations are characterized by

considerable heterogeneity. Under these circumstances, precision of an estimate of sampled mean is appreciably enhanced by recognizing stratifications and modifying the sampling design accordingly. This is accomplished by sub-division, real or imaginary, of the area to be sampled into homogeneous groups which are called strata (single stratum) from each of which sampling units are selected. This method of division of area into homogenous groups is called stratification. In forest inventories this is often done by forming strata by species, site qualities, crop density, etc. For example, if the forest population of 1000 ha is subdivided on the basis of site quality into 4 strata with area 300 ha, in 1 quality, 350 ha in II quality, 200 ha in III quality an 150 ha in IV quality and sampling units are of 0.1 ha, then, for 5% sampling, 150, 175,100 and 75 sampling units will be selected with the help of the table of random numbers or by drawing lots from strata of quality I,II,III and IV respectively.

Multi-stage sampling – In the random sampling described earlier, sampling units are drawn from a population at one time or stage and it is therefore called single stage sampling. But sometimes, it is cheaper to take some samples at that stage and then divide them to take some more sampling units at next stage and so on. As the sampling units are not taken out at one stage but are taken out in two or three stages, the method of sampling is called multi-stage sampling. In this sampling the sampling units get smaller at each successive stage of sampling but the principle of random sampling may be preserved at each stage of selection. For example, a forest population of 100ha may be divided into 200 sampling units of 0.5 ha. With 5% intensity of sampling, 10 sampling units will be selected in the primary stage. Then each of the selected sampling units, may further be broken up into 0.1 ha sampling units. Thus each of them will have 5 sampling units. Now if one or more of these are again selected at random in the second stage, it will become two-stage sampling. The process can be repeated further, if necessary, till the desired stage. Two stage sampling is quite commonly used in forest surveys. For example, a forest to be inventoried might consist of numerous compartments that could be considered primary units in design. Some compartments may be selected in the primary stage. They may be broken into plots of which some would be selected at the secondary stage. Trees selected in these plots for volume measurement could be the third stage of sampling.

Multiphase sampling – This method of sampling is different from the one described above. In this method some of the same sampling units are used at the different phases of sampling to

collect different information or same information by different methods. Two-phase sampling is commonly used in forest inventories and because of the two phases, it is often referred to as double sampling. For example, if the number of bamboo culms in the forest is to be estimated, then in the first phase the number of clumps per hectare is determined by large systematic surveys and in the second phase, number of culms per clump is determined from a small enumeration survey of much smaller area than taken in the first phase. Another example of double sampling in forest inventories is the procedure using a combination of aerial photographic interpretation and field plots. The first phase of sampling consists of estimating the volume on aerial photographs of a large number of relatively inexpensive sampling units employing photo-interpretation and measurement techniques. In the second phase, a subsample of these plots is selected and visited in the field for direct determination of their volumes. This sub-sample is much smaller since field-plots are more expensive to lay than photo-plots. A regression is then obtained between filed plot volumes and photo-plot volumes permitting a corrected volume estimate to be made for the large, less expensive sample of the first phase.

Sampling with varying probability – In the random sampling described above, the chances of selection of all sampling units are the same at all times, But in certain populations, the chances may vary as the sampling proceeds and therefore a modified method of sampling known as sampling with varying probability is used. This method of sampling has become increasingly important in forest inventories in recent years. The 'Bitterlich' or 'variable plot' or 'point sampling' or 'p.p.s.' (probability proportional to size) and 'three p' or 'sampling with probability proportional to prediction' are applications of this aspect of sampling theory.

List sampling – This is another form of sampling with varying probability. The method consists of making a list of sampling units along with their measure of size in any order

(B) Non-Random Sampling

Non-random sampling is that method of sampling in which samples are selected according to the subjective judgment of the observer on the basis of certain rules or guidelines indicating what sample should be chosen. As the selection is based on judgment of the observer, it is likely to be biased. The following variations of this method are used in forest inventories:

Selective sampling – Selective sampling consists of choosing samples according to the subjective judgment of the observer. Selective sampling may give good approximations of population parameters if it is properly used by a person with intensive knowledge of the population. 4 PEA sampling described by Gyde Land and La Bou (picking plots by personal prejudice and /or ease of access) is one of the forms of selective sampling. For quick and rough estimates, this sampling is often employed.

Systematic sampling – Systematic sampling is that method of non-random sampling in which sampling units are selected according to a predetermined pattern without recourse to random selection. Most commonly, the pattern envisages regular spacing of units. For example, sampling units may be located 80 metres apart in rows which may be 200 metres apart. The selection of the first unit may be either random or according to a fixed arbitrary rule and this will result in distinguishing two varieties of systematic sampling. When the first unit is selected at random and other according to a fixed pattern, the sampling is referred to as systematic sampling with a random start.

This method of sampling offers certain advantages as compared to random sampling and is therefore, frequently used in forest inventories in spite of its shortcoming in estimating the variances of the result. The advantages are even greater in tropical forests where environmental conditions hamper field work. Among these advantages are the simplicity and ease in following it, ease of location of sampling units and consequent reduction in cost in reaching it, greater certainty of objectivity in the selection of sample and more uniform distribution of the sample.

Sequential sampling – Sequential sampling is a method of sampling whose characteristic feature is that the number of observations in the sample is not determined in advance but sampling units are taken successively from a population. Each sample includes all the sampling units of the former sample. The confidence interval at each stage will go on decreasing at each stage of sampling is stopped when the desired precision is reached. This type of sampling is usually adopted to test a hypothesis. The hypothesis is tested each time a new observation is made to determine whether the hypothesis should be accepted or rejected. When the decision is made and the hypothesis is accepted or rejected, then the sampling procedure is complete and no further sampling unit is selected beyond the number necessary to make a decision.