3P Sample Scaling

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Agenda

- Introduction
- Brief History
- 3P Sample Selection
- 3P Scaling Procedures
- Sample Expansion
- Pros and Cons

Introduction

- 3P Log Scaling is a Two Stage Sampling Method for Sample Scaling
- Sample Load Scaling with 3P Subsample
- Two Variations currently in use by USFS:
  - 3P Sample Load
  - 3P Sample Weight

3P Log Scaling – Brief History

- Currently Used by the USFS in the Rocky Mountain and Intermountain Regions: Colorado, Idaho, South Dakota, Utah and Wyoming.

- 3P Sampling first developed by Lew Grosenbaugh in the 1960's.

3P Log Scaling – Brief History

- 3P Log Scaling was first tested in the late 1960's and early 1970's in Idaho and Oregon.

- Region 2 began to explore 3P Log Scaling in the early 1970's in part to reduce scaling costs while retaining or improving accuracy.

3P Log Scaling – Brief History

- By 1974 Region 2 held the first formal 3P Sample Log Scaling training in Cortez, CO.

- In 1976, at the request of the Federal Timber Purchasers Association an independent review and evaluation of 3P Scaling was conducted by MSC, Inc. of Boulder, CO.

3P Log Scaling – Brief History

- *“ The basic 3P sampling plan is a highly efficient procedure which produces good estimates of population values with relatively small sample sizes when compared with simple random sampling. It is a highly creative, conceptual scheme, which when appropriately applied, would be highly recommended…”*

Robert H. Taylor, MSC, Inc.

Two Stage Sampling Method

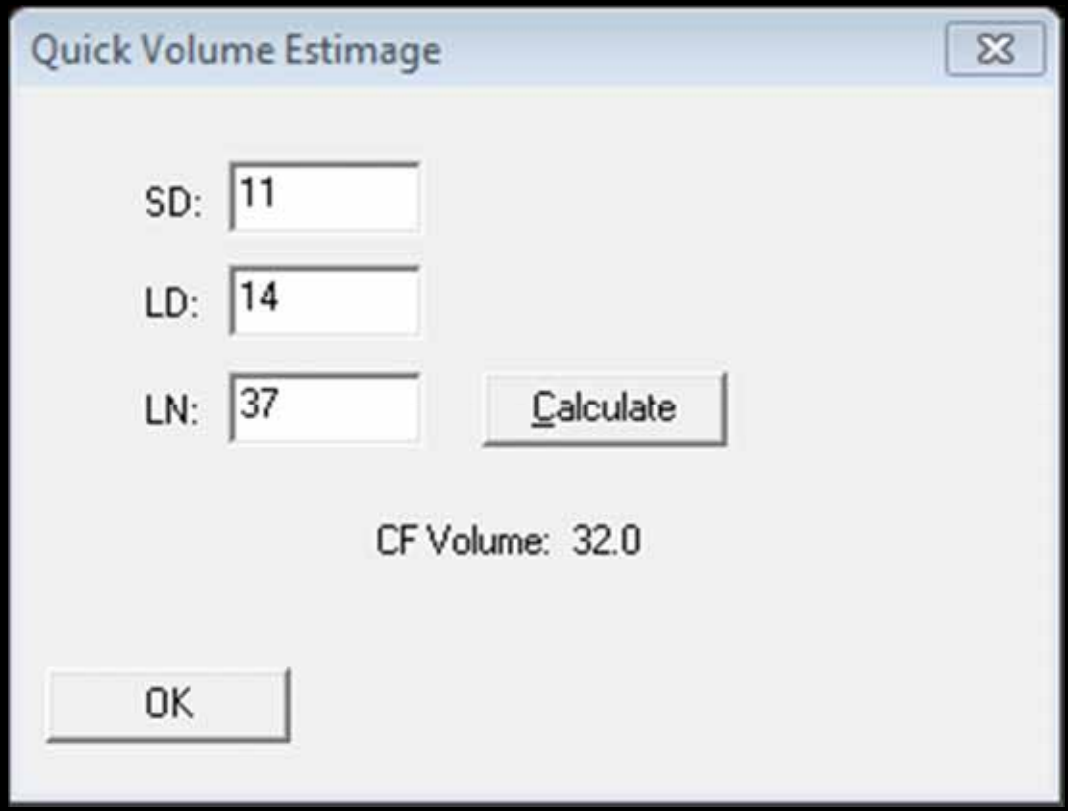
- First Stage – Sample Loads are randomly selected from the total population of loads.
- Second Stage – Sample (Measure) logs are selected from the logs in each of the Sample Loads.

3P Sampling

- In general, the 3P scaling procedure is to estimate the gross volume of each log and scale those logs selected as samples.
- 3P = Probability is Proportional to Prediction
- As applied to log scaling: the probability of a log being selected as a sample log is proportional to the estimated (predicted) gross log volume (KPI).

3P Sample Selection

- In practice the scaler predicts the gross log volume (KPI) by estimating the small end diameter, taper and length.

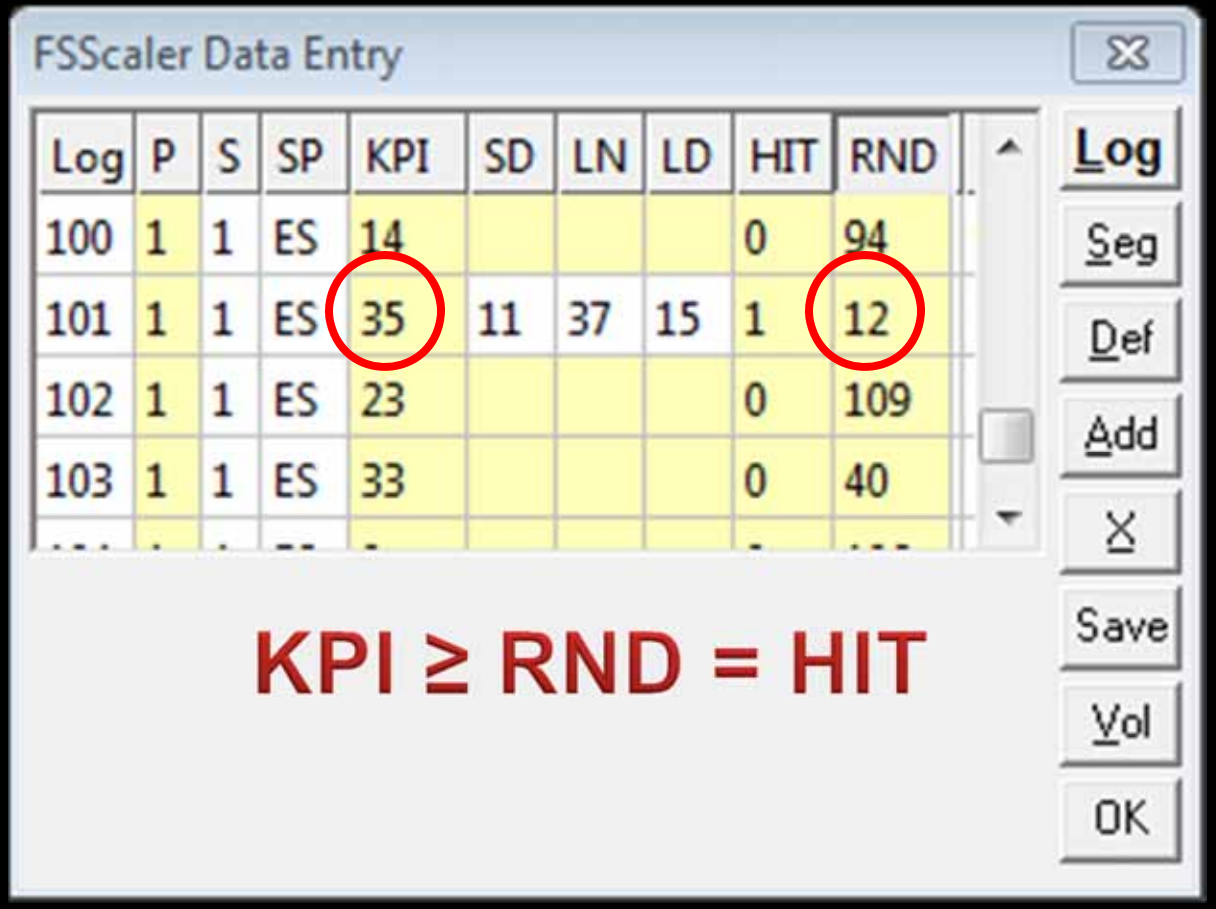


3P Sample Selection

- The KPI is entered into the scaling program which compares it to a random number generated from a specially constructed list.
- If the KPI is ≥ the random number, the log is selected as a measure log.

3P Sample Selection

- Screen-shot example of 3P Scaling Data Entry using FSScaler



3P Sample Selection

- As each sample log is scaled, the measured (scaled) volume is divided by the predicted volume resulting in a Measured/Predicted ratio.
- The variability of the Measured/Predicted Ratio for each sample log is what drives the 3P sampling frequency. Smaller CV = less samples.
- R2 sets the 3P sampling frequency (KZ) to sample approximately 10% of the total logs in a sample load.

Measured to Predicted Ratio

No.	KPI	Gross	Net	Gross M/P Ratio	Net M/P Ratio
5	35	32	28	0.9143	0.8000
26	40	43	37	1.0750	0.9250
32	17	20	11	1.1765	0.6470
35	22	28	24	1.2727	1.0909
54	50	46	38	0.9200	0.7600
68	18	22	18	1.2222	1.0000
70	65	63	58	0.9692	0.8923
		Mean M/P Ratios=		1.0786	0.8736

3P Sample Expansion

- The mean M/P ratio is used to adjusted the total estimated volume (∑KPI).

	Sum KPI	M/P Ratio	Adjusted Volume
Gross	2026.7 CCF	1.0786	2186.0 CCF
Net	2026.7 CCF	0.8736	1770.5 CCF

3P Sample Expansion

- Individual logs are stratified by species and product types.
- Individual Net Ratios per sample groups adjust for variation in defect between species.
- Defect is averaged over all sample logs per sample group.

3P Sample Expansion

- USFS - Scaled volume is reported and adjusted monthly per calendar quarter.
- All reported volume (Sum KPI) within a calendar quarter is adjusted by the mean Gross and Net M/P ratios at the end of a quarter.

3P Sample Expansion

- For Sample Load 3P – Average sample load volume is applied to non-sample loads.
- For Sample Weight 3P – weight to volume ratios are calculated from the total weight and total volume of all sample loads.
- Weight factors are applied to the net weights of all loads to calculate total volume hauled.

Application – Pros

- 3P Sample Log Scaling is used for the majority of stick scaling in R2.
- Very efficient method for small diameter, low value material with large number of pieces per load.
- Works well for sales with 1-2 species and/or similar stumpage rates for different species.

Application - Pros

- Increase in production scaling.
- Improved accuracy for measure logs.
- Gross Volume estimates for each log result in accurate population estimates.

Application - Cons

- Not used for development of weight factors for total weight sales.
- Sample scaling may not be appropriate for high value species.
- May not work well for smaller sales or non-representative loads.

Application - Cons

- Without a separate KZ, minor species or product groups may have fewer samples.
- Hard to predict exact number of sample logs per load.
- May not work well for sales with large variation in defect.

3P vs. Conventional Scaling

- Given sufficient amount of volume, 3P sample scale will be very close to conventional sample load scale.

- USFS 3P certification requires a check scale of 3P scale against conventional scale: must be within 2% of net volume and 1% of gross volume per 20 loads.

Questions ?