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Chapter Contents follow, then Spreadsheets included with the book.

Introduction

... In which,

*the gentle reader
might come to the conclusion
that the author is oriented
toward practical
work,*

*does not intend to write the usual text,
but to sharpen some
fuzzy edges of the business,*

*that he advises patience
in making change,*

*and the reader might
recognize the traits
of people
like themselves.*

THE BASIC IDEAS AND TERMINOLOGY OF STATISTICS

INTRODUCTION

WHY NOT MEASURE ALL THE ITEMS ?

CHARACTERISTICS OF A “GOOD” SAMPLE

WHAT DOES THE TERM “UNBIASED” ACTUALLY MEAN ?

WHEN WOULD A BIASED SAMPLE BE USEFUL ?

WHAT DOES A “SAMPLING ERROR” BECOME ONCE WE ACCEPT THE RESULT ?

OTHER TECHNICAL SAMPLING TERMS

“Population” - specifically the “population of observations”

“Parameter” and “Statistic”

Accuracy and Precision

Bias

AVERAGES

Arithmetic Mean, Quadratic Mean, Other Means

BASIC TERMS OF DESCRIPTIVE STATISTICS

BIG IDEA #1 - The **variability of the population items (x)**
around the true mean (μ)

(Standard Deviation, Coefficient of Variation, Variance)

BIG IDEA #2 - The **variability of the sample mean (\bar{x})**
around the true mean (μ)

(Standard Error (in units or percent) and Variance of the mean)

TABLE OF STATISTICAL TERMS

BIG IDEA #3, **Multiples of one Standard Error** form
a “Sampling Error”

*(Confidence Levels, t-values, Sampling Error,
Confidence Limits and Confidence Intervals)*

SUMMARY AND GRAPH - showing all of these concepts in
a single illustration.

General Measurement Issues

“SCALES” OF NUMBERS (NOMINAL, ORDINAL, INTERVAL AND RATIO)

- 1) “Nominal” data
- 2) “Ordinal” data

Non-Parametric Statistics

Parametric Statistics

- 3) Interval Scales.
- 4) Ratio Scales.

ROUNDING DATA, A CLASSIC ERROR OF DATA MANAGEMENT

Why did people ever round numbers ?

Additional things you should know about rounding

How should we view rounding ?

Rounding for Psychological reasons

What does “rounded” mean ?

Some other false reasoning in rounding

COMBATING DATA ERRORS

Which field measurements are important ?

What is reasonable to expect ?

When should you have rules and standards ?

How many rules should we have ?

Detecting Errors

Individual checks

Overall Checks

Correcting Measurement Errors

Example : Correcting by remeasurement

Example : Correcting by resampling

Specific Forest Measurements

INTRODUCTION

AREA

- What is the area ?
- There is more than one type of “area”
- How do you calculate the area ?
- What is “the precision” of areas computed ?

LOCATION OF SAMPLE POINTS AND TREES

- Where is the sample point ?
- Navigation to the sample point
- Location of the tree

SLOPE ANGLE, VERTICAL AND HORIZONTAL DISTANCE

- Slope Measurement
- Vertical distance, or distance perpendicular to the slope ?
- Horizontal Distance

TREE MEASUREMENTS

- What kind of measurement is being made ?
- Grade and Value Data
- Markets, Destinations and Product Groups
- Defect Determination
 - Defect Method 1 - class deductions
 - Defect Method 2 - type and location deductions
 - Hidden Defect
- Tree Diameter
- Diameter Tape -- or Caliper ?

SELECTING RANDOM & SYSTEMATIC SAMPLES

WHAT IS "RANDOM" SAMPLING ?

Example : Sampling trains for travel direction

Choosing a random point in an area

What does randomness provide you ?

What does random sampling NOT provide you ?

What does "independence" provide you ?

Equal weighting for observations

Selecting sets of items vs. selecting individuals

Selecting random individual items (equal frequency)

Method 1) Single selection plots

Method 2) Equal Selection, equal retention

Method 3) Unequal Selection, unequal retention

Selecting random points on a sphere

Selection of trees by various weightings (non-equal selections)

Selection Proportional to Basal Area

Selection proportional to estimated values per tree

Selection of trees proportional to cubic volume

Why didn't the train sampling method work ?

WHAT IS "SYSTEMATIC" SAMPLING ?

"Matching" observations - the key to efficiency
in systematic sampling

The general procedure for Systematic Sampling

WHAT IS "SYSTEMATIC" SAMPLING ? (CONTINUED)

USING SORTED LISTS

A slight improvement in the sorted list method.

Sorting the list to evenly distribute samples.

"Sorting" with rounded numbers

"Sorting" in more than one dimension with multivariate techniques.

WHAT IS THE SAMPLING ERROR FOR A SYSTEMATIC SAMPLE ?

Technique #1) Use several independent systematic samples.

Technique #2) Fitting a surface to the data

MISSING OBSERVATIONS

What if you "just cannot get" some observations ?

Situation #1 -- it's ugly out there

Situation #2 -- it's really impossible to get the data

"Closely Matching" missing items to minimize bias

Substitute only missing items, or replace the whole set of data ?

Evaluating the bias, and applying a possible correction.

Documenting the Process

CONCLUSIONS

SAMPLE SIZE

BASIC CONCEPTS OF SAMPLE SIZE

“THE” SAMPLE SIZE EQUATION

DIFFERENT APPARENT “FORMS” OF SAMPLE SIZE EQUATIONS

Introducing the “t” value
graph showing the change in “t-value” with
changing sample size.

“t”-table, created using an Excel spreadsheet

THE “FINITE POPULATION CORRECTION FACTOR”

**DIVIDING A TOTAL NUMBER OF PLOTS BETWEEN
SEVERAL SAMPLES**

Suggestions for allocating observations to different samples

AN ILLUSTRATIVE TALE

(a series of memos concerning sample size)

PUBLICATIONS, BOOKS AND COURSES

PUBLICATIONS

- Historical Context of publications
- Why do papers get “published” at all ?
- Which Journal ?
- What is the reward for authors ?
- Acceptance of the paper
- Copy editors
- Multiple Authors
- Readability
- Parts of the Publication
- Data and results
- Tedious Math Details
- Submission of the paper
- Payment & Distribution
- Unofficial Copies
- Accuracy
- Revealing Terminology
- Contacting Authors
- What are useful sources ?

SUGGESTED BOOKS & REFERENCE MATERIAL

GETTING THE MOST OUT OF COURSE INSTRUCTORS

CONFERENCES

- Attending a conference
- Giving a Presentation
 - What are people looking for ?
 - Some specific advice for presentations

STRATIFIED SAMPLING

TYPICAL USES AND SOME ALTERNATIVE METHODS

TRADITIONAL STRATIFICATION.

WHAT IS A "STRATA".

TEN TYPICAL REASONS TO STRATIFY.

A STATISTICAL ISSUE ABOUT COMBINING STRATA.

THE STATISTICAL BENEFITS OF STRATIFICATION.

WHAT IS THE "CORRECT" STRATA ?

What error is caused by "reassigning strata" ?

What caused this problem ?

What was the logical error ?

Changing strata classifications correctly.

Strategy (#1) a new sample

Strategy (#2) Retaining the old data

HOW OFTEN IS THE POLYGON LABEL "WRONG" ?

Simple example of an error matrix.

IS THAT ERROR RATE THE TRUTH ? (NO)

VERIFYING THE ERROR RATE.

Graph indicating the increased *apparent* error rate

WHAT ANSWER GETS STORED BACK INTO THE POLYGON ?

Redistributing the overall answer.

WHAT ARE THE DISADVANTAGES OF STRATIFIED
SAMPLING ?

WHY NOT USE CONTINUOUS VALUES WITHIN STRATA ?

“SAMPLING TO CORRECT” AS A STRATEGY.

TRADITIONAL ALTERNATIVES TO STRATIFICATION
(FOR VARIANCE REDUCTION).

Approach #1 Simple total, estimates used only to
distribute that total.

Approach #2 Ratios or regressions that use the estimates
to improve the total and to produce
individual polygon values.

Method A : Ratio Methods.

Ratio technique #1 : “Ratio of Means” Adjustment.

Ratio technique #2 : “Mean of the Ratios” approach.

Method B : Regression approach.

Computing the regression

SUMMARY OF STRATIFICATION ISSUES

AN AFTERTHOUGHT ... “PSEUDO POST-STRATIFICATION”.

Does “pseudo post-stratification” help ?

Data used to estimate strata size.

Technical Detail --Why Post-stratification does not improve
the Standard Error when strata proportions are
estimated from the data.

HISTORY AND OVERVIEW OF FOREST SAMPLING METHODS

(WITH EMPHASIS ON MEASURING TREES)

NON-SAMPLES

STRIPS

WHAT IS THE RESULT WHEN DISTANCE ERRORS, LINE
PLACEMENT ERRORS AND VARIABILITY ARE COMBINED ?

LINES OF PLOTS

WHERE IS THE PLOT CENTER ON THE NEXT LINE OF
PLOTS ? - TWO METHODS.

“100% COUNT” IN COMBINATION WITH
“PERCENTAGE SELECTION”.

- Method #1 systematic selection of every nth tree
- Method #2 random choice of a percentage of trees
- Method #3 estimating the total number of trees
- Method #4 correcting estimates for the trees

INDEPENDENT RANDOM SAMPLE PLOTS AND THE USE OF
SYSTEMATIC GRIDS.

PLACING THE GRID.

GETTING THE “RIGHT NUMBER” OF PLOTS WITH YOUR GRID.

- Shifting the grid to get the sample size.
- Logic of the problem in controlling sample size.
- Increasing the Sample size from the grid.
- Decreasing the sample size from the grid.
- What should you do ?

FIXED PLOTS IN FOREST SAMPLING

What "percent sample" is obtained ?

Stand Value.

Subsampling Fixed Plots.

Fixed Plot slope correction.

VARIABLE PLOT SAMPLING

Walter Bitterlich

Lew Grosenbaugh

Don and Dave Bruce -- father and son

John Bell & Lu Alexander (West Coast)

Tom Beers & George Furnival (East Coast)

Introduction of Variable Plot Sampling into North America

3P SAMPLING.

WHAT IS THE NEXT BIG CHANGE ?

SAMPLING WITH LINES (TRANSECTS)

INTRODUCTION

SAMPLING APPLICATIONS FOR THIS TECHNIQUE.

PLACEMENT ISSUES.

SAMPLING APPLICATION #1) **DETERMINING AREA PERCENTS**

Sampling points along a line - a "depth" issue.

SAMPLING APPLICATION #2) **VOLUME DETERMINATION.**

Using the average "depth" along a transect to compute volume.

Coarse Woody Debris - A special case.

Idea #1 - Use actual cross-sectional area to get depth.

Idea #2 - Use an ellipse to get the cross-sectional area.

Getting the area of an ellipse directly.

What if the piece is not circular in cross-section?

Correcting a circular area to calculate the "average ellipse".

Vertical correction.

Horizontal correction.

Idea #3 - Correct the area, but based on the average correction, rather than each piece individually.

Summary of the transect sample process.

Idea #4 - You could get an average cross-section for each piece, regardless of the diameter at the crossing point.

SAMPLING APPLICATION #3) **GETTING THE LENGTH
OF LINES FROM TRANSECTS.**

Total Length of lines within an area.

Number of Pieces.

A more general approach to selection and measurement :

Suppose we want something more than total length or volume.

What exactly does “the length” mean ?

Average “Piece Length”.

Straight transects or bent ones ?

What if you run into the boundary ?

Method #1 : The “bounce-back method”.

An incorrect alternative.

Method #2 : The “Wrap-around” method.

SUMMARY.

A FEW SPECIAL CASES -

WHAT IF YOU ALWAYS CROSS AT A RIGHT ANGLE ?

Example #1, “Flushing distances” -- translating line distance into birds.

Example #2, Horizontal Line Sampling - A case of crossing “expanded diameters” along the transect.

Example #3, Minowa’s Method. Standing trees viewed at a 45° angle.

3P SAMPLING

INTRODUCTION.

WHAT IS THE BASIC IDEA ?

Estimation Stage.

Measurement Stage.

Comparison of 3P sampling to the philosophy
of Log Scaling.

Similar systems.

RARE SPECIES.

Rare items - without specific measurements available.

SELECTION OF THE SAMPLE TREES.

Transforming the random number.

Appropriate Control of the Sample size.

“K+Z”, an historical artifact.

Are the trees chosen with “the proper frequency”?

Results by category

What if you guess the wrong “expected sum
of the estimates” in the planning stage?

How can you get an exact sample size?

STATISTICAL ISSUES.

ADVANCED TOPICS IN 3P SAMPLING, AND PROBLEM SOLVING.

IMPROVING THE STANDARD ERROR.

MULTIPLE RESULTS.

WHAT SAMPLING PRECISION SHOULD BE EXPECTED ?

TYPICAL PROBLEMS.

Small trees.

Trees near the merchantability limit.

ADDING AND SUBTRACTING TREES OR AREAS AFTER THE

CRUISE IS COMPLETED.

- 1) Perhaps you can anticipate the removal
before it happens.

2) If your data cannot identify the trees removed, what can you do ?

- a) Approximate solutions with some bias involved.
- b) Unbiased Solutions.

A 3P “removals cruise” can correct other cruising systems.

AUDITING TO VERIFY ACCURACY.

Sample Trees.

Estimates.

“CONCERNS” WHEN INTRODUCING 3P SAMPLING.

Will the Measurements be right ?

Will all the trees be found ? (or will some be left off on purpose ?)

Will the random numbers be OK ?

Will the KPI be “correct” ?

Can we detect fraud ?

CHECKING A 3P CRUISE FOR PURCHASE.

Simple approach.

Example : Correction of a 3P sale.

A second method for correcting a 3P cruise.

Example : A second correction method for the buyer.

Balancing the Effort

TREES LARGER THAN KZ.

HOW TO SALVAGE AN “OFF-TRACK” 3P SAMPLE.

WHAT MINIMUM SIZE TREE SHOULD YOU INCLUDE IN THE SAMPLE ?

THE FPC (FINITE POPULATION CORRECTION FACTOR).

EXTENSION OF 3P SAMPLING TO LARGE AREAS.

General Theory.

TALE OF A 3P FIELD EXERCISE.

The Setting

The Estimates.

The Measurements.

The Crew.

The Sting.

Postscript.

VARIABLE PLOT SAMPLING

INTRODUCTION.

VARIABLE PLOT SAMPLING IN FORESTRY.

Getting away from actual units.

MEASURING THE RELATIVE BASAL AREA OF THE STAND.

How to “expand” a stump area.

CONVERTING PERCENTAGE TO ACTUAL BASAL
AREA IN UNITS.

A Practical Problem : Are you inside the invisible plot ?

BASAL AREA FACTOR - THE LOGIC AND THE MATH.

The First Basic Formula of VP sampling :

Logical form.

The First Basic Formula of VP sampling :

Mathematical form.

EXACT DETERMINATION FOR “BORDERLINE TREES”.

EXTENDING THE PROCESS TO COMPUTE VOLUME
AND OTHER VALUES.

Method 1) “Expand” each individual tree.

Method 2) Relate the measured item to basal area
using a sub-sample.

STATISTICS OF VARIABLE PLOT SAMPLING

Quick Estimates of Stand Volume

INTERMEDIATE TOPICS IN VARIABLE PLOT SAMPLING.

CAN YOU COMBINE DATA GATHERED WITH SEVERAL BAFs
AT DIFFERENT POINTS ?

Techniques for combining data.

USING SEVERAL BAFs TO DESCRIBE DIFFERENT
TREE SIZE CLASSES.

USING FIXED PLOTS FOR SMALL TREE DATA

DO YOU GET "POOR RESULTS FOR SMALL TREES" WITH
VARIABLE PLOTS ?

COUNTING TREES.

- How Much Does it Matter ?
- Is the purpose of the angle gauge simply to "choose trees" ?
- How can accuracy be verified ?
- What Average Tree Count is desirable, and why ?
- Using a "temporary" choice of BAF.
- How should we decide the BAF to use ?
- Using an approximate Basal Area.
- Metric vs. English BAF (and all other units).
- Why not switch prisms until you get a desired count
at each point ?
- How can you handle "too many" or "too few" trees
at a point ?
- Will mistakes in deciding "in and out" trees "average out" ?
- Tree Count Errors
- What tree types should be included in the sample ?
- How should trees be grouped and analyzed ?

INSTRUMENTATION.

- Where is the instrument held ?
- Crude angle gauges.
- Prisms.
- How to hold the prism.
- How can you modify the shape of prisms ?
- Prism calibration
- Why use an "even" BAF ?
- Relascopes.

DETERMINING THE "IN" TREES.

- What is the "correct" diameter at the sighting height ?
- Does the DBH measurement need to be accurate
on measured trees ?
- How should "borderline tree" status be decided ?
- Use of Plot Radius Factor (PRF) for borderline trees
- Hidden Trees
- Broken Trees

Contents continued on next page

MEASURING TREES.

Balancing the effort.

How would you get rough estimates of these two CVs ?

What total numbers of counts & tree measurements are needed ?

Should you measure individual trees or clusters of trees ?

Methods of choosing individual Trees

- 1) Choose one tree per plot.
- 2) Choose every "n'th" tree.
- 3) Make Random selections during the cruise.
- 4) Use the "Big BAF" method.

Getting a measurement from each species.

Grade information & Dollar Values.

Weighting the VBAR information.

Example : Weighting VBARS.

Falling trees to improve the accuracy of the data

OTHER ANGLE COUNT METHODS.**FUTURE DEVELOPMENTS IN VP SAMPLING :****CRITICAL HEIGHT SAMPLING.**

How do we find the "Critical Point" ?

Summary of the Critical Height Method

Applications for the Critical Height Method:

EDGE EFFECT PROBLEMS AND THEIR SOLUTIONS

INTRODUCTION : WHY DOES THE PROBLEM EXIST ?

Avoidance of the Edge

Method-caused bias

How is the sampling bias caused ?

WHAT ARE THE METHODS TO CORRECT THE PROBLEM ?

Method #1) “Assumptions” Approach

Can we assume that errors balance between polygons ?

Can we assume that the edge is the same as the interior ?

Method #2) “Direct Correction” for the portion of the tree circle falling outside the boundary.

Practical Problems

Method #3) “Folding” methods that move portions of the tree circle back inside the boundary.

Grosenbaugh’s Method

“Mirage” Method

Method #3a) Details - Grosenbaugh’s Method

Practical Problems

Conclusion

Method #3b, Details - “Mirage” Method

Practical Problems

Conclusion

The “Walkthrough” Method

Method #4) The “Toss back” method, which puts the tree circle areas back, but not by “folding”

Practical Problems

Conclusion

Method #4a, An unbiased “Area Free” total basal area

Method #5) Biased Systems

Method 5a, The “Interior Sweep”

Method 5b, The “Exterior Sweep”

HOW CAN WE ELIMINATE SOME OF THESE TROUBLESOME EDGES ?

What if the “net” area must be sampled ?

EXACTLY WHAT IS “THE POLYGON” ?

RECOMMENDATIONS

REFERENCES

GROWTH ESTIMATION AND MONITORING

INTRODUCTION

WHAT TYPE OF PLOT ?

GROWTH & YIELD ISSUES

Growth Models

CFI (Continuous Forest Inventory) plots or Research Plots ?

Plot shape & area

Plot Identification

Measurements

Major Change Processes

Plots that are “ruined” -- should they be discontinued ?

Demonstration areas

EXTENSIONS OF VARIABLE PLOT SAMPLING TO 4 DIMENSIONS :

Critical Height sampling for change over time

Historical and Recent Methods

GROWTH PREDICTION WITH VARIABLE PLOTS

Method #1, Subtract the volumes of measurements

at “time 2” and “time 1”

(different plot sizes for a specific tree at each time)

Method #2a, Maintain the same plot size

(Using the plot size at “time 1”)

Additional change when switching angle gauges

Method #2b, Maintain the same the plot size

(Using the plot size at “time 2”)

Compatible methods

Method #3a, (Iles Method)

Method #3b, (Flewelling’s Method)

CONCLUSIONS

MONITORING

THE GREAT MONITORING DEBATES, A TALE IN 3 PARTS

ACT I Freddie gets deeply into fertilizer

ACT II Freddie Struggles Back

ACT III Freddie gets close, but no cigar

THE ROLE OF REGRESSION IN RESOURCE SAMPLING

WHAT IS THE OBJECTIVE ?

SOURCES OF ERROR

REGRESSION AS A TECHNICAL FIELD

TERMS USED IN REGRESSION

HOW WELL DOES THE LINE "FIT"

WHAT EQUATION SHOULD BE USED ?

TESTS THAT CAN BE DONE WITH REGRESSION RESULTS

Is the regression equation "significant" ?

What is the significance of adding (or subtracting) a new variable ?

Is one Regression "superior" to another ?

Is there a "lack of fit" in the regression line ?

Illustration of lack of fit of equation

Lack of Fit & Pure Error "F-test"

Residuals showing lack of fit

WHAT ARE THE "BELIEVABLE VALUES" FOR EACH COEFFICIENT ?

DO YOU HAVE TO USE THIS EXACT CALCULATED COEFFICIENT ?

"ERRORS" IN A REGRESSION RESULT

ARE RESIDUALS REALLY "NORMALLY DISTRIBUTED" ?

WILL THE EQUATION WORK ON THE NEXT SET OF DATA ?

WHY USE REGRESSION ?

ALTERNATIVES TO REGRESSION

Alternative #1 : Fitting the equation by eye

Alternative #2 : Use the means,
(especially for 1 variable relationships)

Alternative #3 : Use a Table ?
(for 2-variable relationships)

Alternative #4 : Why not interpolate between
“guide lines” ?

OPTIONS TO IMPROVE THE FIT OF THE REGRESSION

Option #1 : Fitting the equation by parts

Option #2 : Transformations

Option #3 : Separate the data

WHAT DOES THE REGRESSION MULTIPLIER “MEAN” ?

WHAT IS “ R^2 ” AS IT IS APPLIED TO REGRESSION ?

WHAT ABOUT THE “SIGNIFICANCE” OF R^2 .

“HIGH LEVERAGE” POINTS

“MULTICOLLINEARITY”

THE BIOLOGIST AND THE HEATHEN PROFESSOR -
A CASE STUDY IN REGRESSION

HYPOTHESIS TESTING

INTRODUCTION

PART 1

WHAT ARE INFERENTIAL STATISTICS AND HYPOTHESIS TESTS?

WHEN WOULD YOU DO HYPOTHESIS TESTING ?

THE INTERPRETATION OF EVIDENCE:

WHAT IS “A HYPOTHESIS” - PARTICULARLY THE
“NULL HYPOTHESIS” ?

FORMAL AND INFORMAL TESTING

IMPORTANT - OR ONLY “SIGNIFICANT” ?

CAN YOU “PROVE A NEGATIVE” ?

LIMITS TO INTERPRETING THE RESULTS

The Basic Idea

Point #1a : It’s only *this* data we are talking about.

Point #1b : ... and it reflects our level of effort (sample size).

Point #2 : It depends upon how clever we are, and what
we know ahead of time.

Point #3 : We get to set the level of “proof” required.

Point #4 : “I did not find it” is not the same statement
as “It is not there”.

THE RESULT WAS NOT CONCLUSIVE. NOW WHAT ?

SUMMARY

PART 2

AN ADDED OPTION - “ACCEPTING” A HYPOTHESIS

“Accepting” a Hypothesis - When can we do it ?

The “Power” of a test to reject a false idea

SUMMARY OF OUTCOME POSSIBILITIES & ERROR TYPES

EXAMPLE: THE NATIVE, THE PIRANHAS, AND THE PH.D.

WHAT IS THE CONNECTION BETWEEN HYPOTHESIS TESTS
AND CONFIDENCE LIMITS ?

THE “POWER” TO REJECT A HYPOTHESIS

POWER COMPUTATION

DESCRIBING AN EXPERIMENTAL PLAN USING β AND
POWER CALCULATIONS :

SUMMARY OF HYPOTHESIS TESTING IDEAS

PART 3

A TALE OF TWO SEMINARS

PART 4

SPECIFIC HYPOTHESIS TESTS USED IN RESOURCE SAMPLING

Why are there so many different Significance tests ?

How do all hypothesis tests work ?

TEST TYPE #1 - TEST OF MEANS (t-TEST)

Example of a t-test

Where should we put the “Rejection Region” ?

Example : A Typical “two-tailed” t-test.

Example : “the one-tailed t-test”.

A More complicated example.

A Historical Example of rejection region placement.

The overall form of a t-test is always the same.

“Paired” and “Unpaired” t-tests

TEST TYPE #2 - TESTING THE “VARIABILITY” (F-TEST)

Using the F-test to examine several groups

{the “Analysis of Variance” or “ANOVA”}

TEST TYPE #3 - TESTING THE “SHAPE” OF A POPULATION

{ χ^2 TEST}

Table of Spreadsheets

Read the “ReadMe.rtf file on the CD before using

General

STAR_BAR	Planning Variable Plot cruises and many functions for Variable Plot Sampling Calculations.
STRATA	Stratified Sample Planning.
Conv_Uni	Convert English and Metric Units.
INTERP	2-way interpolation of a table you enter.
SDI	Compute Stand Density Indexes Reinke, Drew & Flewelling, Curtis.
Relascope	Relascope Values for any different bar combinations the user enters, and a complete list for American, Metric and Wide Scale Model BAFs.
XBAR	Simulate a sample from actual or generated data, with graphs of all statistics at all sample sizes.
Grouped	Computes grouped statistics from data entered by the user.

Chapter Spreadsheets

These are often initially set up to illustrate the examples in the text, but by changing the input data you can view changes that would occur with other data from your own files.

Chapter 2, inside spreadsheet CH02.xls Statistical Terms Chapter

Example 2.09	Computation of basic statistics.
“t-value” computation	From entered “confidence level” & “n”.
weighted average	From entered data and <i>assigned</i> weights.

Chapter 3, inside spreadsheet CH03.xls
General Measurements Chapter

Convert Angles	Convert between Degrees, Topographic, Radians and Percent angles.
Rounding in EXCEL	Illustration of how EXCEL rounds.
Example 3.9.a	Ratio Correction to data with errors.
Example 3.9.b	Ratio Correction when tree counts were taken in a biased fashion.

Chapter 4, inside spreadsheet CH04.xls
Specific Measurements Chapter

Examples 4.1 & 4.2	Calculation of tree height.
Example 4.3	Tree height calculation by pole at tree base.
Example 4.4	Tree height calculation by pole <u>not</u> at tree base
Example 4.6	Finding “% crown”, distance not known.
Example 4.7	Quick determination, relative basal area growth.
Example 4.9	Stand age, weighted by tree basal area.
ChG Vm	Growth, metric Variable Plot Measurements.
ChG Ve	Growth, English Variable Plot Measurements.
ChG Fm	Growth, metric Fixed Plot Measurements.
ChG Fe	Growth, English Fixed Plot Measurements.

Chapter 5, inside spreadsheet CH05.xls
Random and Systematic Sample Chapter

Sys Sample	Systematic Sample of data entered by user.
Earth	Selecting Random samples on the face of the earth.
Fig 5a-d	Systematic sample results, Figures 5a-5d. The user can also use their own data.
Graphs 5a-d	Graphs of the results from these examples.
Example 5.2	Choosing a random sample in a polygon.
Example 5.3	Inverse Selection Method.
Example 5.4	Selection with Arbitrary Weights.
Example 5.9	Valid Sampling Error of a Systematic Sample.
Example 5.11	Effect of substituting Sample Plots.

Chapter 6, inside spreadsheet CH06.xls
Sample Size Chapter

Calculate n	Simple calculation of sample size.
Calculate t	Calculate simple “t-value” and SE% for various standard confidence levels.
Effective t	Calculate t-value for a series of sample sizes where the results are combined (as in a stratified sample).
t-table	Standard t-table and values for <u>any</u> confidence level entered, and graphs of that data.
Efficiency	Relative efficiency of systems with different CV’s and different costs per sample.

Chapter 8, inside spreadsheet CH08.xls
Stratified Sampling Chapter

Example 8.01a	Example, Stratified vs. Unstratified results.
Example 8.01b	Example of optimum allocation.
Example 8.01c	Combining Standard Errors, Stratified Sampling.
Example 8.02	Advantages of stratification, Ratio Sampling.
Example 8.03	Bias caused by changing strata based on field data.
Example 8.07	Costs of Simple vs. Optimum sampling.
Example 8.10	“Ratio of Means” calculations.
Example 8.11	“Mean of Ratios” calculations.
Example 8.12	“pseudo-stratification” mathematics.

Chapter 9, inside spreadsheet CH09.xls
History and Overview of Forest Sampling Chapter

Example 9.01	Effect of line length variability, strip sampling.
Example 9.02	Testing for error in computed strip sample area.
Example 9.04	Calculating effect of extra samples in rare species.
Example 9.08	Statistics for "Ratio of Means" estimates.
Example 9.09	Effect of an incorrect grid placement.
Example 9.13	Sampling Error from strip sampling.

Chapter 10, inside spreadsheet CH10.xls

Line Sampling Chapter

Example 10.01	Statistics, area by species, with strips.
Example 10.02	Transects with points, foliage area along them.
Example 10.03	Transect with points, and leaf angle measured.
Transect, English	Coarse Woody Debris transect, English.
Transect, Metric	Coarse Woody Debris transect, Metric.
Example 10.09	Expansion of values by estimated numbers of pieces.
Example 10.09m	Computation by total length vs. sections.
Example 10.10b	Computation with total length vs. sections.
Example 10.14b	Horizontal Line Sampling for any measured value.

Chapter 11, inside spreadsheet CH11.xls

3P Sampling Chapter

Example 11.02	Optimal Allocation, 3P sampling.
Example 11.03	Distributing an unbiased total with biased species totals.
Example 11.04	Statistics for a 3P cruise.
Example 11.05	3P sample correction using sellers data.
Example 11.06	3P sample correction as a 3 ^d stage.
Example 11.07	3P optimal sample allocation of 3 stages.

Chapter 12, inside spreadsheet CH12.xls

Variable Plot Sampling Chapter

Example 12.03+12.05a	Illustration of the “expansion method”.
Example 12.06	Different size classes with different BAFs.
Example 12.07	Statistics for number of trees per acre.
Example 12.08	Calculated Effect of missing one tree.
Example 12.10	Calculation of Plot Radius Factors from BAF.
Example 12.12	Balancing Effort in Tree Counts and Measurements.
Example 12.13	Computing Weighted VBARS and statistics.
Example 12.14a	Balancing Tree Counts, standing measurements and felled trees.

Example 12.14b	Statistics for 3-stage VP sampling.
Example 12.16	Critical Height calculations, volume and growth.
TPA English	Calculation of trees/ <u>acre</u> .
TPH Metric	Calculation of trees/ <u>hectare</u> .

Chapter 13, inside spreadsheet CH13.xls

Point-3P Sampling Chapter

Example 13.01	Point-3P cruising of individual trees.
Example 13.02	Point-3P cruising of entire plots.
Example 13.03	Sample size for 3-stage Point-3P sampling.

Chapter 14, inside spreadsheet CH14.xls

Edge Effect Correction Chapter

Direct Correction	Correction based on distance to plot edge.
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Chapter 16, inside spreadsheet CH16.xls

Regression Chapter

Lack of Fit	Calculating and testing the regression “lack of fit”.
F-probabilities	Calculation of critical “F-ratios”.

Chapter 17, inside spreadsheet CH17.xls

Hypothesis Testing Chapter

Example 17.04a	Two-tailed hypothesis test setup, mean=30.
Example 17.05	Power Computation, mean = 40.
Example 17.07	Power Computation, mean = 60.
Curve Areas	General area under curve computation.
Example 17.12	Two-tailed hypothesis test setup.
Example 17.13-14	One-tailed test setup.
Example 17.15	Rejection Regions not on the tails.
Example 17.18	F-test
F-probabilities	Calculation of critical “F-ratios”.
Example 17.19	Analysis of Variance computation