Resource Inventory Notes

BLM-2 November 1976

A TEST OF THE STATISTICAL VALIDITY OF A 3P AND POINT SAMPLING DESIGN

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ABSTRACT - Statistical assumptions basic to 3P sampling were satisfied in a point sampling study in West Virginia

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A point sampling scheme has been described where the number of logs on a "in-trees" is recorded by species at the majority of points and careful measurements of "in-trees" are made at a few points selected by 3P sampling (Wiant 1974). A test of the statistical assumptions basic to this system was made using data collected on a point sample cruise (BAF=10) of a 3500-acre portion of the West Virginia University Forest. That forest, comprised of mixed Appalachian hardwoods, was 35 years old at the time of the cruise. Form class 78 volume tables developed by Mesavage and Girard (1946) were used for volume estimates.

Procedure

Using the combined 3P and point sampling procedure, the average number of logs recorded at all points is converted to a per-acre volume estimate by the relation:

$$V = \left(\frac{1}{n}\right)\left(\Sigma\frac{Y}{X}\right) Z$$

where:

V = per-acre volume estimate
n = number of 3P point samples

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Σ = sum
Y = measured per-acre volume at a 3P point sample
X = total number of logs at a 3P point sample
Z = average number of logs at all point samples

This is a mean-of-ratios estimation, which assumes the relation of Y to X is in the form of a straight line passing through the origin and the standard deviation of Y at a given level of X is proportional to X. In contrast, linear regression procedures assume the variability of Y is the same for all levels of X, and the ratio-of-means estimation $\left(\frac{\Sigma Y}{\Sigma X}\right)$ assumes the standard deviation of Y at any given level of X is proportional to the square root of X (Freese 1962). Data from 295 point samples were used to test these assumptions.

Results

A linear regression of Y to X indicated a strong relation (r = 0.99) of the form:

$$Y = 46 + 656X$$

A test of the null hypothesis that the line goes through the origin, as suggested by Snedecor and Cochran (1967), yielded a t-value which was not significant at the 5 percent level (1.956, d.f. = 293).

Therefore, the assumption that the line goes through the origin was accepted.

An examination of Table 1 indicates that the assumption that the standard deviation of Y is proportional to X, as is made in 3P sampling, fits the data better than assuming the standard deviation is constant or proportional to the square root of X. As Freese (1962) points out, there are numerous other forms of ratio estimators, but these are the more common.

In view of the popularity of 3P sampling schemes, other tests of basic assumptions are needed.

Literature Cited

Freese, F. 1962. Elementary forest sampling. USDA Forest Service, Agr. Handbook 232.

Mesavage, C., and J. W. Girard. 1946. Tables for estimating board-foot volume of timber. USDA Forest Service, Govt. Printing Office, Washington, D.C.

Snedecor, G. W., and W. G. Cochran. 1967. Statistical methods. Iowa State Univ. Press, Ames.

Wiant, Jr., H.V. 1974. Combine 3P and point sampling for efficient cruising. West Virginia Forestry Notes 2:12-15.

TABLE 1

Statistics for a Point Sample Cruise on the

West Virginia University Forest

Total number of logs at point sample (X)	Number of point samples	For per-acre volumes (Y) Standard deviation (S)	S/X	$S/\sqrt{X}$
0.5	14	21	43	30
1.0	33	51	51	51
1.5	28	71	47	58
2.0	17	108	54	77
2.5	25	215	86	136
3.0	23	142	47	82
3.5	31	222	64	119
4.0	19	165	41	82
4.5	22	172	38	81
5.0	18	293	59	131
5.5	11	408	74	174
6.0	9	264	44	108
6.5	10	398	61	156
7.0	16	331	47	125
8.0	9	249	31	88
9.0	10	256	28	85

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Next issue "Inventorying the Urban Forest" by Jim Geiger, Forester, City of Chicago.

CURRENT LITERATURE

RECREATION

"Landscape Assessment-value, Perceptions, and Resources," edited by Zube, Brush and Fabos is available from Dowden, Hutchinson and Ross Inc., 523 Sarah Street, Strodsburg, Pa 18360. Price unknown. The 367 pages provide a comprehensive overview of current research in landscape perception and a close look at the development of landscape assessment methods.

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Gen. Tech. Report RM-25 "Measuring Scenic Beauty: A Selected Annotated Bibliography" can be obtained from Rocky Mountain Forest and Range Experiment Station, 240 West Prospect Street, Fort Collins, Colorado 80521. Also ask for Gen. Tech Report RM-26 "A Descriptive Inventory of Ponderosa Pine on National Forests in the Salt-Verde Basin, Arizona".

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RANGE

Station Note #25 "Application of Color Infrared 70mm Photography for Assessing Grazing Impacts on Stream-Meadow Ecosystems" may be obtained from Forest, Wildlife and Range Experiment Station, College of Forestry, University of Idaho, Moscow, Idaho 83843.

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FORESTRY

Several publications by the Interational Union of Forestry Research Organizations (IUFRO) Remote Sensing Subject Group (S6.05) are available. They include:

- "Application of Remote Sensors in Forestry." Freiburg 1971, 189 pages, 13 contributions.
- "Proceedings of the Symposium IUFRO S6.05, Freiburg 1973." 570 pages, 323 contributions.
- "Proceedings of the Oslo Meeting of IUFRO S6.05" 1976. About 600 pages and more than 50 contributions.

Proceedings and prices may be obtained from Prof. Dr. G. Hildebrandt, Erbprinzanstr. 17a, D7800 Freiburg i.Br., Fed. Rep. of Germany.

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A statistical and analytical report on the third forest survey of New Hampshire can be found in Resource Bulletin NE-43 "The Forest Resources of New Hampshire" by Neal Kingsley. Copies can be ordered from Northeastern Forest Experiment Station, 6816 Market Street, Upper Darby, Pennsylvania 19082.

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Several publications that are of interest to inventory specialists are available from the Pacific Northwest Forest and Range Experiment Station, P.O. Box 3141, Portland Oregon 97208. These include:

- "Water-pump Air Samples for Use at Remote Sites" by Pickford, Charlson and Buettner.

- Reprint "Evaluating Accuracy of Tree Measurements made with Optical Instruments: by David Bruce.

- Res. Note PNW 102 - "Sequential Sampling of Douglas Fir Tussock Moth Populations" by Dick Mason.

- Res. Note PNW 269 - "Cubic-foot Volume Tables and Equations for Young-growth Western Hemlock and Sitka Spruce in Southeastern Alaska" by Bill Farr and Jim LaBau.

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The August 1976 issue of the Journal of Forestry, Vol 74, No. 8, p. 526-531, has a very interesting article on "Forest Type Mapping with Satellite Data" by Dodge and Bryant. Copies of the Journal may be available at your local library.

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"Approximate Sampling Variance of Adjusted 3P Estimates" by L. R. Grosenbaugh. June 1976, (Forest Science, 22: 173-176); and

"Diameter Measurements in the Line Intersect Method" by Van Wagner and Wilson, June 1976 (Forest Science 22: 230-232), may also be available at your library.

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Several reprints are available from the Forestry Department, University of Tennessee, P.O. Box 1071, Knoxville, Tennessee 37901. These include:

- "Point 3P Sampling: A Useful Timber Inventory Design" by John Rennie, For. Chron., June 1976, 145-146.

- "A Comparison of Tree Volume Estimation Methods for West Tennessee Hardwoods" by Rennie and Boehmer, 1975, Tennessee Farm and Home Science Progress Report, 96.

- "Predicting Diameter Inside Bark for Some Hardwoods in West Tennessee" by Boehmer and Rennie, Wood Science 8 (4): 209-212, 1976.

- "Three-P Sampling of Fixed-Area Permanent Growth Plots" by Kunz and Rennie, The Consultant, 1976, 21: 75-76.

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WILDLIFE

The April, 1976 issue of the Journal of Wildlife Management (Volume 40, Number 2) has several articles of interest. They include:

- "Experiments in Aerial Survey" by Caughley, Sinclair and Scott-Kemmis, p 290-300.

- "Deer Trail Counts as an Index to Populations and Habitat Use" by McCafferty, p 308.316.

- "Deer Browse Inventories in the Louisiana Coastal Plain" by Pearson and Sternitzke, p 326-329.

- "Further Aspects of Bias in Aerial Census of Large Mammals", p 368.

For further information about the Journal of Wildlife Management, write the Wildlife Society, Suite 611, 7101 Wisconsin Avenue, Washington, D.C. 20014.

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Two publications on wildlife inventories are available from USDI Fish and Wildlife Service, Denver Wildlife Research Center, Denver, Colorado 80225. These include "Indices of Predator Abundance in the Western United States" by Robert D. Roughten and "Determing the Relative Abundance of Coyotes by Scent Station Lines" by Linhard and Knoulton.

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Copies of the "Sherburne National Wildlife Refuge Master Plan" are available from the U.S. Fish and Wildlife Service, Minneapolis, Minnesota. The computerized inventory and resource analysis are explained and illustrated.

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Publication No. 20 "Limnetic Zooplankton Dynamics in Beaver Reservoir including an Inventory of Copepod Species and an Evaluation of Vertical Sampling Methods" by E. H. Schmitz can be obtained from Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, AR 72701.

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The U.S. Department of the Interior, Office of Library Services, Washington, D.C. 20240 has recently published "Electrofishing for Population Sampling - A Selected Bibliography" by Ruth Friedman. Ask for Bibliography Series No. 31.

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GENERAL

The 1975 S.A.F. Proceedings "America's Renewable Resource Potential" contains a very interesting collection of papers under "Land Capability Classification and Integrated Inventories for Land-Use Planning," copies of the proceeding are available for $10. from the Society of American Foresters, 5400 Grosvenor Lane, Bethesda, MD 20014.

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The April 1976, Vol. 28, No. 2 issue of Agricultural Economics Research has an interesting article on "Using Area Point Samples and Airphotos to Estimate Land Use Change" on pages 65-74. Copies of Agricultural Economics Research may be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Single copies are $1.00 each.

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Speaking of Aerial Photography -- drop us a card and will send you a copy of Technical Note 287 "The Use of Aerial Photographs" by Richard Burr. This note covers the basic background necessary for understanding and using aerial photographs for resource management.

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Copies of "Conservation Needs Inventory for Land Resource Planning, Stillwater County, Montana" 1972, are available from USDA Soil Conservation Service, P.O. Box 970, Bozeman, Montana 59715. The report sumarrizes the results of an inventory of cropland, rangeland and woodlands of the county.

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"Map/Model System" which describes locational information processing for planning and management of resource is available from the Bureau of Governmental Research and Service, University of Oregon, P.O. Box 3177, Eugene, Oregon 97403.

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An excellent publicaiton, "Area Frame Sampling in Agriculture" is available from the USDA Statistical Reporting Service, Washington, D.C. 20250. Ask for SRS No. 20.

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"A Model from the Determination of Wildland Resource Values" is available from the Director, Division of Cooperative Forest Fire Control, USDA Forest Service, Washington, D.C. 20250. The study provides an interim system to determine the total value of all damageable resources on a state-wide basis.

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"Computer Mapping of Wildfire Hazard Areas, A User-Oriented Case Study" by Craig Tom and Tim Getter and "An Ecosystem Guide for Mountain Land Planning, Level I" (Price $4.00) by Dennis Lynch are available from the Colorado State Forest Service, Forestry Building, Room 206, Colorado State University, Fort Collins, Colorado 80523.

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MISCELLANEOUS

New Inventory Work Group Officers.

The SAF Inventory Working Group recently elected new officers for the calendar years 1977 and 1978. The new chairman will be Gyde Lund, Forester with the Bureau of Land Management's Service Center, Denver, Colorado.

The chairman-elect is Dave Bower, Forest Biometrician with Weyerhauser Company in Centralia, Washington. Dave Robinson was elected as Secretary for the Working Group. Dave is Associate Professor in Forestry at Oklahoma State University.

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Wanted! Articles for the "Notes". Please send all correspondence to the address on the front page, Attention: Resource Inventory Notes.

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