Timothy G. Gregoire

Resource Inventory Notes

BLM 20

April 1979

CANADA COMMITTEE ON ECOLOGICAL LAND CLASSIFICATION

by

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Background

Since the late 1960's, there has been a growing need to characterize the environment for resource planning and management. This arose because decisionmakers were increasingly having to consider the impacts of programs on the environment as well as on society. This in turn meant that there were a greater number of ecological baseline studies, and of research projects in support of them, being carried out. Several national workshops attended by representatives of governmental and private agencies recommended the establishment of a technical committee to coordinate and report on the development of baseline studies.

In an attempt to meet these coordination concerns, the Lands Directorate of Environment Canada in cooperation with other federal and provincial agencies organized a meeting at which was founded the Canada Committee on Ecological Land Classification, (CCELC). At this meeting, held in 1976, the objectives, organization, membership and working groups were decided.

Objectives

The general objectives of the CCELC are to encourage the continued development and to promote the application of a uniform ecological approach to land classification. These objectives are to be achieved through:

- technical information exchange and organization of problem-oriented working groups and workshops;
- encouragement and wide distribution of information on methodology and procedure of ecological land classification;

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USDI, Bureau of Land Management, D 340
Denver Service Center, Denver Federal Center, Bldg. 50
Denver, Colorado, 80225

- the initiation of dialogue with the general public, users and potential users on the presentation and application of ecological data base; and

- recommendations and advice to governmental and private agencies on the application, feasibility, methodology, benefits and costs of ecological land surveys.

Organization

Membership of the CCELC is of one representative for each province and one for each of the key federal agencies. In addition, specialists from universities, provincial and federal agencies, and leaders of ecological baseline studies are invited to participate. Currently, the chairman is J. Thie of Environment Canada.

The overall activities of the CCELC are coordinated through a Secretariat, staffed and funded by the Lands Directorate, Environment Canada. Secretariat functions include the editing and publication of CCELC Newsletters, working papers and reports; and the organizing and overseeing of CCELC national meetings, projects and working groups.

The committee presently has five working groups: Methodology/Philosophy, Applications, Data Systems, Wetland Classification and Land/Water Integration. These groups were formed as a result of specific recommendations of the initial CCELC meeting and are aimed at addressing particular aspects of ecological land classification which either have made significant gains or will require further study.

Activities and Publications

In addition to Working Groups activities, the CCELC, since its inception, has sponsored national workshops on Ecological Land Classification in Urban Areas, on Land/Water Integration and on Wetlands. Also, the CCELC has held two national meetings. The first focussed on the status of Ecological Land Classification in Canada and the second on the Applications of an ecological data base. Some of these activities are reported among the following list of publications:

Canada Committee on Ecological Land Classification, 1977. Ecological Land Classification in Canada: Proceedings of the first meeting of the CCELC, May, 1976. Edited by J. Thie and G. Ironside, 269p.

_____, 1977. Ecological Land Classification in Urban Areas: Proceedings of a workshop, November, 1976. Edited by E. Wiken and G. Ironsdie, 167p.

_____, Newsletters. Edited by E. B. Wiken and G. Ironside.

No. 1: The CCELC, Background, Objectives and Working Groups;
No. 2: Land Survey in Canada, an Index and Terminology;
No. 3: Chairman's Report;
No. 4: Wildlife Data in Ecological Land Classification;
No. 5: The Vegetation Component in Ecological Land Classification.

Land/Water Integration Working Group. 1977. Land/Water Integration: Proceedings of the first meeting, February 1977. Edited by D. Welch, 70p.

Methodology/Philosophy Working Group. 1977. Philosophy of Ecological Land Classification. Compiled and edited by S. Rowe, 16p.

From now (1978) until the early 1980's CCELC activities will focus on user training, land classification workshops, revised guidelines for ecological land surveys, the preparation of an Ecoregion Map of Canada, and the development of methods of handling and applying an ecological data base.

For More Information

Please contact the CCELC Secretariat: CCELC Secteatariat, Lands Directorate, Environment Canada, Ottawa, Canada K1A OE7 or telephone (819) 997-2320.

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THE PRECISION OF DOT GRID ESTIMATES: A THEORATICAL APPROACH

by

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Abstract

Several methods have been developed for estimation of unbiased standard errors for counts with systematically spaced dot grids. Some of them are quite efficient. This paper shows a theoretical approach and it gives a simple and correct formula.

Introduction

Loetsch, Zöhrer and Haller (1973), and Zöhrer (1978) give special formulae to determine the standard error of an area estimated with dot grid. These formulae have been developed empirically. Matheron (1965) gives a formula based on a theoretical approach but his formula is not easy to use. Other formulae have been obtained from Matheron's works. See Bouchon (1975)

For systematically spaced dot grid, a simple and correct formula is:

$$CV\ (\hat{s})\% = 50\ P^{0.5} N^{-0.75}$$

where CV coefficient of variation or relative error, S area to be estimated and $\hat{S}$ its estimation ($S = Na^2$, a = distance between dots), N number of dots in S, p perimeter ratio (perimeter of S divided by the perimeter of a circle of the same size).

Demonstration

Here is a short-cut demonstration. For more details see CHEVROU (1976).
(1) Let S be the area to be estimated and L its perimeter. Superimpose on S a network of equally spaced parallel lines with common distance a. S form on these lines n segments of respective length f (x + ka), k being the index of the k th segment, and x being a random variable (o,a) varying with the position of S on the network.

(11) $\hat{S} = a \sum_{k=1}^{n} f\ (x + ka)$ is an unbiaised estimation of S

(12) $\hat{S} - S = a \sum_{k=1}^{n} f'\ (ka + x_k)$, f' being the first derivative and x_k being a certain value (0,a) depending on κ.

(13) $Var\ \hat{S} = E\ (\hat{S} - S)^2 = a^4\ ng\ (n)$, E for expectation and ng (n) being a function of some variables including the parameter n.

NB: The function ng (n) is so written to make the text clearer.

(2) Now change the parallel lines into lines of equally spaced dots, with common distance b, so that the dots form a rectangular dot grid with equally spaced dots, the common distance being a in a direction, b in the perpendicular direction.
mk dots are on the k th segment.

(21) $m_k b$ is an unbiaised estimate of f (x + ka)

(22) it can be shown that, in average, COV (mk,mj) = 0 for $K \neq j$, and Var mk = 1/6, that is the average of q (1 - q) for q uniformly distributed in (0,1).

It comes:

(23) $\hat{S} = ab \sum_{k=1}^{n} m_k = Nab$ and $E\ (\hat{S}) = S$

(24) $Var\ \hat{S} = a^2\ b^2 \frac{n}{6} + a^4\ ng\ (n)$

(3) The number of intersections between L and the lines of the network is 2n, and the average value of this number is (See the Buffon needle problem):

$$(31)\quad E(2n) = \frac{2L}{\pi a} = 4p\sqrt{\frac{ab}{ba}}\ \frac{1}{\sqrt{\pi}}\sqrt{N}$$

(4) enter E (n) in place of n in (24) and write u in place of b/a =

$$(41)\quad E(\mathrm{Var}\ \hat{S}) = 2\,a^2\,b^2\,p\ \frac{1}{\sqrt{\pi}}\sqrt{N}\left[\frac{\sqrt{u}}{6} + g\,(n)\ \frac{1}{\sqrt{u^3}}\right]$$

(5) Suppose now that we would have worked with a network of parallel lines perpendicular to the initial network, with interval b, and dots on these lines with common distance a. We would have obtained with the same u = b/a:

$$(51)\quad E(\mathrm{Var}\ \hat{S}) = 2\,a^2\,b^2\,P\ \frac{1}{\sqrt{\pi}}\sqrt{N}\left[\frac{1}{6\sqrt{u}} + g\,(n)\ \sqrt{u^3}\right]$$

(41) and (51) should give the same result. Equally the two expressions gives g (n) which is $\frac{1}{18}$ at most and valid when u not too for from 1.

(6) A special case is a = b corresponding to a systematically spaced dot square grid:

$$(61)\quad \hat{S} = Na^2 \text{ and } E(\hat{S}) = S$$

$$(62)\quad \mathrm{Var}\ \hat{S} = \frac{4}{9\sqrt{\pi}}\,pa^4\sqrt{N} \text{ or } = \mathrm{Var}\ \hat{S} = \frac{2}{9\pi}\,a^3 L = \frac{2}{89}\,na^4$$

$$(63)\quad CV\ (\hat{S})\% = 50\,p^{0.5}\,N^{-0.75}$$

$$(64)\quad \log CV\ (\hat{S})\% = 1.70 + 0.5 \log p - 0.75 \log N \text{ to be compared to Zöhrer's formula (1979).}$$

Pseudo-Systematic Dot Grid:

Suppose a rectangular grid of squares of side a. Place a dot at random in each square. Put the area S on this grid.

N_1 squares are entirely inside S and N_2 squares are crossed by the perimeter L. In each of the N_2 squares, the part of S is q a^2, with q between 0 and 1, the average value of q a^2 being $\frac{a^2}{2}$ and the average variance of q (1 - q) being $\frac{1}{6}$.

L leaving a square when entering the next one, the number of intersections between L and the sides of the squares is at least N_2.

It comes:

$$\hat{S} = Na^2 \quad \sim \quad (N_1 + \frac{N_2}{2})\, a^2 \text{ and } E(\hat{S}) = S$$

$$E(N_2) = \frac{4L}{\pi a} \text{ and } E\,(\text{Var } \hat{S}) \text{ is at most } \frac{2}{3\pi}\, a^3 L$$

$$CV\ (\hat{S})\% = 87\ p^{0.5}\ N^{-0.75}$$

Application

When a straight part of the perimeter L is parallel to the lines of dots bias may occur for $\hat{S}$ or Var $\hat{S}$ If it cannot be avoided use a pseudo-systematic dot grid.

In some case it is recommended to use the observed value of n (half the number of segments in S for the two directions of the dot lines) instead of its expectation (31). See formulae (62) above.

There is little to gain in accuracy by using a very accurate value of p. A rough estimate of p is generally good enough. When S is formed of separated area, the formula is valid when using a correct value of p.

The formula (63) or (64) is not quite correct for very small values of N. See Matheron (1965).

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Literature Cited

BOUCHON J. 1975 - Précision des mesures de superficie par comptage de points. Ann. Sci. forest. 1975, 32 (2): 131 - 134.

CHEVROU R. B. 1976. Précisions des mesures de superficie estimée par grille de points ou intersections de paralleles. Ann. Sci. forest. 1976, 33 (4); 257 - 269.

LOETSCH F., ZOHRER F., and K. E. HALLER 1973. Forest inventory, vol. II, Munchen, BLV Verlag.

MATHERON G. 1965. Les variables régionaliséeset leur estimation, Masson et Cie, PARIS, 1965, pp 106 -110.

ZOHRER F. 1978. On the precision of dot grid estimates. Resource inventory notes, BLM 12, July 1978, p. 1 - 6.

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Current Literature

Please order directly from addresses given below:

General

KODAK Pub. M-76 "Photo interpretation for Land Manager" from Professional, Commercial and Industrial Markets Division, Eastman Kodak Company, Rochester, NY 14650 - price $1.50.

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Tech. Paper 317 "Army Research Institute Evaluation of Automated Data on Instructional Technology (ADIT)"

Tech. Paper 328 "The Value of Special Training for the Interpretation of UGS (Unattended Ground Sensors) Employed in a Grid"

Tech. Paper 334. "Vehicle Identification Using the Acoustic Sensor: Training, Sensing Concepts, and Band Width."

Tech. Paper 348 "Total System Accuracy for APPS (The Analytical Photogrammetric Positioning System)"

Tech. Paper 349. "Selective Feedback as a Training Aid to On-line Tactical Data Inputting."

All from U.S. Army Res. Inst. for Behavioral and Social Sciences, 5001 Eisenhower Ave., Alexandria, Va. 22333

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Gen. Tech. Report. INT-45 "Graphic Aids for Field Calculation of Dead, Down Fuels."

Res. Paper INT-215 "Grazing on National Forest Systems Lands: Cost of Increasing Capacity in the Northern Region."

From Intermountain Forest and Range Exp. Sta., 507 25th St., Ogden, UT 84401.

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Forestry

The Jan. 79 Issue of Forest Industries contains several articles on the use of computer in the timber industries. Check for a copy at your local conservation library.

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Bull 730. "Keys to Common Trees of the Southeast." from Coop. Extension Service, University of Georgia, Athens, Ga. 30602.

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Infor. Report FMR-X-113. "Identification of Tropical Trees on Aerial Photographs" from Forest Management Inst., Dept. of Fisheries and Environ., Majestic Bldg., Rm. 404, 396 Cooper St., Ottawa Ontario, Canada.

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"Board Foot Factors for Point Sampling" by Harry Wiant & Bill Maxey in Journal of Forestry 77(1): 20 Jan. 79 at your local conservation library.

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State Forest Notes 71 "Timber Projections for California Production vs. Consumption" from State of California, Dept. of Forestry, 1416 Ninth St., Sacramento, CA. 95814

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Recreation

"Sight line, Perspective Plot, Scope-Three Desktop Computer Programs for Forest Landscape Design" by D. B. Nickerson - in Journal of Forestry 77 (1): 14-17, Jan 79. At your local conservation library.

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Res. Paper INT-142 "Visitor Perception of Wilderness Recreation Carrying Capacity"

Report "Measuring Trail Conditions with Stereo Photography" by Rinehart et. al.

Both from Intermountain Forest and Range Exp. Station, 507 25th St., Ogden, UT. 84401.

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Watershed & Soils

MP-929 "Conversions and Units in Non-Point Source Pollution." from Maryland Agric, Exp. Sta., College Park, MD 20740.

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Publication No. 80. "The Value of Data Acquisition from Water Quality Monitoring" from Water Resource Research Center, A-211 Graduate Research Center, University of Massachusetts, Amherst, MA. 01003.

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Tech. Bull. No. 1596 "Methods for Sampling and Assessing Deposits of Insecticidal Sprays Released over Forests" For Sale by Superintendent of Documents, US Gov't. Printing Office, Washington, D.C. 20402. Stock No. 001-000-03866-4 - Price unknown.

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Ext. Bull. 835, "Soil Evaluation for Subsurface Sewage Disposal" from Coop. Extension Serv., Oregon State University, Extension Hall, Corvalls, OR. 97331.

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"Modelling the Water Quality of the Hydrological Cycle" - Proc. of the Baden Symposium, Sept. 78. Order from The Treasurer IAHS, 1909 K. Street NW, Washington, D.C. 20006. Price is $37 for the 382 paged publication.

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Wildlife & Fisheries

Reprint - "U.S. Fish and Wildlife Service Habitat Evaluation Procedure (HEP)."

Reprint - "Evaluating Wetlands as Wildlife Habitat"

Reprint - "The Habitat Evaluation Procedures: Their Application in Project Planning and Impact Evaluation."

All from Project Impact Evaluation, Div. of Ecological Services, U.S. Fish & Wildlife Service, 22625 Redwing Rds., Ft. Collins, CO. 80526.

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INFO. Leaflet No. 175
"Stock Seperation Studies of Alaskan Salmon Based on Scale Pattern Analysis" from Alaska Dept. of Fish and Game, Subport Bldg., Juneau, AK. 99801.

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Neb. Tech. Series No. 4 "Fishes of the Channelized Missouri - Age - Growth, Length - Frequency, Length - Weight, Coefficient of Condition, Catch Curves and Mortality of 25 Species of Channelized Missouri River Fishes" from Nebraska Game and Park Commission, P. O. Box 30370, Lincoln, NE. 68503.

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Tech. Note 325 "Use of Large-Scale, Color Infrared Photography for Stream Habitat Inventory" by Paul Cuplin. Drop us a line - Attention D-360 for a copy.

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Satellite Hydrology - will be the topic for the Fifth Annual William T. Pecora Memorial Symposium to be held June 11-15, 1979, in Souix Falls, S. D. For details contact Donald R. Wiesnet, NOAA/NESS, S-33, Washington, D.C. 20233

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Advanced Topics in the Analysis of Remote Sensing Data. Intended for individuals who are concerned with numerical analysis of remote sensing data and who have already acquired knowledge of and experience with fundamentals of quantitative remote sensing. Dates May 14-18, 79. Fee $595.

Workshop on Remote Sensing Field Research - June 25-26 at Purdue University. Scene characterization, spectral data acquisition and calibration, data analysis and instrumentation systems will be covered.

Machine Processing of Remotely Sensed Data - A symposium, June 27-29, 1979 at Purdue University. Emphasis will be on Research Results in:

1. Digital representation and understanding of remotely sensed scenes.
2. Utilization of digitally processed earth resource data.
3. Extraction of information primarily from digital remotely sensed earth resource data.

For information on any of these meetings contact Purdue University, Laboratory for Applications of Remote Sensing, West Lafayette, IN. 47907.

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Sampling on Successive Occasions - A workshop sponsored by Department of Forest and Wood Sciences, Colorado State University, S.A.F. Inventory Working Group and IUFRO S4.02-03 will be held July 17-20, 1979. The workshop is designed for resource managers and researchers engaged in sampling projects such as national and state timber surveys, multi-resource inventories, timber inventories on industry-owned lands, etc. A knowledge of basic sampling technique is assumed. The course will be limited to 40 people and will cover expected values, probability sampling, best linear unbiased estimates, independent estimates remeasurement, sampling with partial replacement, optimum sample sized and sampling on more than two occasions. The fee is $250. Contact Office of Conferences and Institutes, Residential Conference Center, Colorado State University, Fort Collings, Colorado 80523.

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August 19-24, 1979 - "Air and Space Technology in the Forest Environment" Humboldt State University, Arcata, California, USA, 95521

The practical combination of older, with new, proven techniques and technology to answer forest resource management and data management needs and international applications of the technology with case studies from

the United States, Canada, Europe, and South America are covered, $300 fee, includes full syllabus, training materials plus banquets and special luncheons. $100 deposit due May 15, 1979. Contact NASA Technology Transfer Project, Humboldt State University, Arcata, California, USA, 95521. (707) 826-3112.

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1979 Forest Inventory Workshop. This workshop is designed to appeal to land managers, inventory specialists, practitioners, data analysts and biometricians. This national meeting is sponsored by the SAF Inventory and Biometrics Working Groups, IUFRO Subject Groups S4.02 and S6.02 and by Colorado State University. Over 84 papers will deal with such subjects as Multi-Resource Inventories, Biometrics, Inventory Projection and growth, Inventories on Successive Occasions, Sampling Techniques.

Sampling Aspects of Aerial Photography, Computer Uses in Resource Inventories, Tropical Inventories, Biomass Measurement, Biomass Inventory, Metric Con-Version Strategies, Product Estimation and a series of Contributed papers. Registration fee is $75. The dates are July 23-26, 1979, at Colorado State University. For details contact Office of Conference and Institutes, Residential Conference Center, Colorado State University, Fort Collins, Colorado 80523.

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Forest Photogrammetry - A short course will cover use of Aerial Photos in Type Mapping, Measurements, Flight Planning etc. The dates are August 27-31, 1979 at V.P.I. The fee will be $22. For details contact Adult Register, Donaldson Brown Center for Continuing Education, Virginia Polytechnic Institute and State University, Blacksburg, VA. 24061. Phone (703) 961-5182.

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Coming is 1980! Arid Land Resource Inventory - workshop sponsored by the Mexican Forest Service and the Society of American Forester's Inventory working Group. Dates are November 30 - December 6, 1980 and the place La Paz, Mexico. Watch the Notes for further details and plan to attend.

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IUFRO Subject Group S.4.02 has New Officers. The International Union of Forestry Research Organizations Resource Inventory Subject group has new officers as follows:

S4.02.01 Tropical Inventories.
Chairman - Andrew Nash, University of Missouri, USA
Co-chairman - Phillip Kio, University of IBADAN, Nigeria
Co-chairman - J. P. Lanly. FAO, Italy

S4.02.02 Temperate Inventories
Chairman - Kullervo Kuusela, Forest Research Inst. Finland
Co-chairman - H. Gyde Lund, BLM, USA

S4.02.03 Successive Inventories
Chairman - Vacant
Co-chairman Warren E. Frayer, Colo. State University, USA.

S4.02.04 Data Processing
Chairman - Walter Schopfer, Fed. Rep. of Germany
Co-chairman - Joe Barnard, US F.S., USA

We've combined the RIN Mailing list with those on BLM's Scientific Systems Development (D-140) list of BLM attendees at Remote Sensings Workshops. The intent is to merge the SSD Newsletter into Reosurce Inventory Notes. We expect to carry more information on Remote Sensing in future issues.

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Wanted! Lead articles, current literature and meeting announcements for publishing in the "Notes". If announcing a meeting, please allow at least a four month lag time.

Change of Address? Be sure to send us your old label. If you want to get on or off our mailing list, drop us a line.

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