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CURRICULUM VITAE

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Science strives for the discovery of significant Scientific Truth. It is Statistics that takes care of the uncertainty of the Scientific Method consisting of design, analysis, and interpretation, and even the assessment of significance. The society in which we live has chosen to fully use Statistics as a decisive instrument to deal with societal crises, whether they be related to environment, education, economy, energy, engineering or excellence. While it is exciting that we are alive in the age of information, and while it is unfortunate that we find ourselves in the crisis of environment, it is only a bliss to have the opportunity to more effectively serve the cross-disciplinary cause of statistics, ecology, environment, public health and society in the research, training, and outreach setting.

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Abstract

1. Fellow, American Statistical Association (1967); Fellow, American Association of Advancement of Science (1968); Elected , International Statistical Institute (1967); Fellow, Institute of Mathematical Statistics (1972); Founder Fellow, National Institute of Ecology, India (1978); Plenary Lecture, Fourth International Congress of Ecology (1986); First Distinguished Statistical Ecologist Award, International Association for Ecology (1986); Most Significant Paper Award, American Fisheries Society (1987); General Methodology Lecture, American Statistical Association (1987); Honorary Doctorate in Biological Sciences, University of Parma, Italy (1988); Honorary Doctor of Letters, University of Poona, India (1989); Visiting Professor of Biostatistics, Harvard School of Public Health, Harvard University (1986-1988); Distinguished Professor, Penn State (1990); Honorary Fellow, International Indian Statistical Association (1998); Honorary Visiting Professor at the Centre for Policy Research, New Delhi, India (1998-1999); Distinguished Lukacs Professor, Department of Mathematics and Statistics, Bowling Green State University, Bowling Green, Ohio, Spring 1999; Honorary Professor at the Centre for Clean Environment Technology, Bangalore University, Bangalore, India (1999).

2. Chairman, Committee on Fellows and Awards, ASA Section on Statistics and the Environment (1990-1992); Member, Editorial Advisory Board, Environmetrics, International Environmetric Society (1992-); Distinguished Achievement Medal Award for Statistics and the Environment, American Statistical Association, (1993); Chairman, Committee on Statistics and Environment Medals, ASA Section on Statistics and the Environment (1993-1995 and 1996-1997); Chairman, Distinguished Statistical Ecologist Award Committee, Statistical Ecology Section of the International Association for Ecology (1990-); Keynote Speaker, First French Conference on Ecology and Statistics (1994); Plenary Lecture and Popular Evening Lecture, First Indian Ecology Congress, 1996; Banquet Lecture, Statistics for 21st Century Symposium, 1998; Keynote Inaugural Address, Ninth Lukacs Symposium on Frontiers of Environmental and Ecological Statistics (1999); Plenary Lecture, 50th Anniversary of German Colloquium in Freiburg (1999); Plenary Lecture, National Italian Ecological Congress (1999); Plenary Lecture, International Biometric Conference in Brazil (1999); Keynote Inaugural Address, National Convention in Statistics and the Environment in Argentina (1999); Plenary Lecture, International Bernoulli Society Program in India (2000); Invited Lecture, Indian Science Congress (1999, 2000); Inaugural Keynote Address, Annual Meeting of the National Statistical Society, Slovenia (2000); Plenary Lecture, Portuguese Statistical Congress (2001); Plenary Lecture, Brazilian Ecological Congress (2001). Joint Inaugural Lecture with C. R. Rao, International Conference on Environment and Health related Quality of Life: Statistical Perspectives, France (2002); Plenary Lecture, Remote Sensing for the Environment, MISTRA, Stockholm, Sweden (2002).

3. Founder Chair of Statistical Ecology Section of International Association for Ecology. Founder of Statistical Ecology Section of Ecological Society of America. Founder of Statistical Ecology Section of National Institute of Ecology, India. Founder Chair of Statistics and the Environment Section of American Statistical Association. Founder Vice-Chair of the Standing Committee for Environmental Statistics of International Statistical Institute. Founder Editor-in-Chief, Environmental and Ecological Statistics, Kluwer Academic Publishers. Founder Advisory Council Member of International Indian Statistical Association.

4. Consultant, USDA, Forest Service; Consultant, NIH, Laboratory of Applied Studies, DCRT; Consultant, EPA, Statistics Review Committee; Consultant, National Marine Fisheries Service; Member, Research Advisory Committee, EPRI; Member Research Advisory Committee, GRI; Member,

ASA Committee on Statistics and Environment; Member, ASA Committee on Statistics in Wildlife and Fisheries Research; Member, Program Committee, Society for Risk Analysis; Member, Steering Committee of the Symposium on Statistics and the Environment at the National Academy of Sciences; Member, EPA-ASA Peer Review Committee on Acid Deposition; Member, NOAA Chesapeake Bay Stock Assessment Committee; Board Member, International Center for Theoretical and Applied Ecology, Italy; Vice Chairman, Scientific Program Committee, International Conference on Biomathematics, Xi'an, China; Program Chairman, Publications Officer, and Elected Section Chair, ASA Section on Statistics and the Environment; Member, Program Committee and Chair, Ecological Risk Assessment Committee, ASA Conference on Environmental Risk Assessment: Statistical Issues and Methods; Consulting Member, Biomonitoring and Ecosystems Objectives Working Groups, EPA Region II, New York; Member, Statistics Panel, Shrimp Fishery By Catch Program, the Gulf and South Atlantic Fisheries Development Foundation; Member, Program Committee, Mahalanobis Birth Centenary Conference on Environmental Statistics; Chairman, Penn State India Advisory Task Force; Member, Penn State Environmental Science and Technology Council; United States Delegate to the NAFTA Trilateral Meeting for Environmental Information and Reporting. Moderator, Inter-Agency Workshop on Environmental Monitoring and Assessment; Vice-President, ISEM, Beijing, China, Ecological Modeling Progress to Meet the Challenge of Sustainable Development; Executive Committee, SPRUCE III, Yucatan, Mexico, Statistical Aspects of Pollution: Assessment and Control; Science Advisory Board, Spatial Accuracy Assessment in Natural Resources and Environmental Sciences, USFS International Symposium; Convenor, Ninth Lukacs Symposium in association with ten professional societies responsible for statistical ecology, environmental statistics, and risk assessment; Member, International Organizing Committee, Third International Congress on Ecosystem Health; Member, Special Science Advisory Panel, The Human Environment Index: A Tool for Measuring the Human Impact on the Environment, UNEP; Member, Special Panel, United Nations Industrial Development Organization, International Center for Science and Technology, Trieste, Italy.

5. Author and co-author of 300 research publications in refereed volumes and professional journals, like, *Annals of Mathematical Statistics*, *Biometrika*, *Biometrics*, *Cambridge Philosophical Transactions*, *Environmetrics*, *Journal of the American Statistical Association*, *Journal of Royal Statistical Society*, *Researches in Population Ecology*, *Sankhya*, *Technometrics*, *Statistical Distributions in Scientific Work*, *Statistical Ecology*, etc. Subject areas of research interest include: Mathematical and Applied Statistics, Statistical Ecology, Environmental Statistics, Theory of Statistical Distributions and Applications, Risk Analysis, Multiple Time Series, Spatial Statistics, Generalized Linear Models, Errors in Variables Analysis, Survey Design and Sampling, Environmental Sampling and Observational Economy, Site Characterization and Evaluation, Biodiversity Measurement and Comparison, Small and Skew Data, Encountered Data Analysis and Interpretation, Environmental Indicators and Statistics in Environmental Policy, Remote Sensing and Multi-Scale Assessment, Hotspot Detection and Prioritization. Best Paper Awards from American Fisheries Society and from American Water Resources Association.

6. Editor-in-Chief, *Environmental and Ecological Statistics*, Kluwer Academic Publishers, Massachusetts and The Netherlands. Editor, monograph series in environmental and ecological statistics, Kluwer Academic Publishers. Editor (with C. R. Rao), *Handbook of Statistics, Volume 12: Environmental Statistics*, and Editor (with C. R. Rao), *Multivariate Environmental Statistics*, North Holland/Elsevier Science Publishers, New York and Amsterdam, 1993. Guest Editor, Penn State Statistical Ecology and Environmental Statistics Silver Jubilee Special Issue of COENOSSES, 1995; Guest Editor (with G. Cantor, E. Landau, and C. Russell), *American Statistician*, November Special Issue for Statistics, Law, and the Environment, 1985; Author of a 3-volume series on *Modern Dictionary and Bibliography of Statistical Distributions in Scientific Work* with Citation Index and Subject Classification, 1985, (Co-authored variously with M. T. Boswell, S. W. Joshi, M. V.

Ratnaparkhi, and J. J. J. Roux), International Co-operative Publishing House, Fairland, Maryland; Author of *Dictionary and Bibliography of Discrete Distributions* (with S. W. Joshi), Oliver Boyd, Ltd., 1968, in the International Statistical Institute Series; Editor, *Classical and Contagious Discrete Distributions*, Statistical Publishing Society, Calcutta and Pergamon Press, 1965; Editor, *Random Counts in Scientific Work*, Volumes 1, 2, 3, The Pennsylvania State University Press, 1970; Editor (with E. C. Pielou and W. E. Waters), *Statistical Ecology*, Volumes 1, 2, 3, The Pennsylvania State University Press, 1971; Editor (with S. Kotz and J. K. Ord), *Statistical Distributions in Scientific Work*, Volumes 1, 2, 3, The D. Reidel Publishing Company, Dordrecht, and Boston, 1975, in the NATO Advanced Study Institute Series; Editor (with C. Taillie and B. Baldessari), *Statistical Distributions in Scientific Work*, Volumes 4, 5, 6, The D. Reidel Publishing Company, Dordrecht, and Boston, 1981, in the NATO Advanced Study Institute Series; Editor of 5 volumes in a 10-volume series in *Statistical Ecology* expanded from the Satellite Program in Statistical Ecology held in USA, Italy, and Israel, (Co-edited variously with Cairns, Cormack, Grassle, Ord, Robson, Rosenzweig, Smith, Taillie, and Waters), International Cooperative Publishing House, Fairland, 1979.

7. Conceived and organized the International Symposium on Discrete Distributions in 1963 at McGill University. Program Chairman for Biometric Society at AAAS, 1968. Conceived and organized the Symposium on Random Counts in Scientific Work. Conceived and organized as Director and Program Co-Chairman the First International Symposium on Statistical Ecology in 1969 at Yale University. Chairman of the International Statistical Ecology Program which consists of the ISI-BS-INTECOL Liaison Committee on Statistical Ecology and the INTECOL Statistical Ecology Section. Director of the First NSF Advanced Institute on Statistical Ecology in the United States, 1972. Conceived and organized as Director the International Program on Statistical Distributions in Scientific Work in 1974 at Calgary, Canada. Conceived and organized as Director the Satellite Program in Statistical Ecology in USA, Europe, and Israel in 1977 and 1978. Presented invited papers at 50 International Conferences and Symposia. Chaired sessions at 25 of them, including the Moscow International Mathematical Congress, 1966, the International Statistical Institute, Washington, D. C., 1971, and Manila, Philippines, 1979, and the International Congress of Ecology, Jerusalem, 1978. Conceived and organized as Chairman the International Summer School on Statistical Distributions in Scientific Work in 1980 at Trieste, Italy. Conceived and organized (with Richard Hennemuth) as Co-Chairman, the Statistical Ecology Initiative Program during the International Conference on Renewable Resource Inventories for Monitoring Changes and Trends, Corvallis, Oregon, 1983. Conceived and organized (with C. R. Rao and M. Zelen) as Chairman, the Advanced Research Conference on Weighted Distributions, Observational Studies, Encountered Data Analysis, and Representativeness Issues. Penn State, Amsterdam, and New Delhi 1985. Conceived and organized (with R. C. Hennemuth and D. Simberloff) as Chairman, the Frontiers of Statistical Ecology Program at the Fourth International Congress of Ecology, Syracuse, 1986. Conceived and organized (with Shiro Kobayashi) as Co-Chairman, the Statistical Ecology Symposium at the Fifth International Congress of Ecology, Yokohama, Japan, 1990. Conceived and organized (with C. R. Rao and N. P. Ross) as Chairman, the Multivariate Environmental Statistics Program at the Seventh International Conference on Multivariate Analysis, University Park, PA, 1992. Conceived and organized (with J. N. R. Jeffers and W. E. Waters) as Chairman, the Frontiers of Statistical Ecology and Environmental Statistics Program as the Silver Jubilee of Statistical Ecology at the Sixth International Congress of Ecology, Manchester, UK, 1994, and at the Seventh Congress in Florence, Italy, 1998. Convenor, Ninth Lukacs Symposium for Environmental and Ecological Statistics in the 21st Century, 1999.

8. Passed the SSC Examination of Bombay State in 1949 standing first in the District and fifth in the state among several hundred thousand candidates. Attended Ferguson College and the University of Poona, 1949-1955. First in the First Class with Distinction at every college and university

examination. Won several prizes and scholarships for academic distinction, including Dakshina Fellowship in Maharashtra and Research Fellowship at the Indian Statistical Institute where AISI ("Professional Doctorate") of the Institute was obtained. Earned M.S. and Ph.D. in Mathematics in 1959 at the University of Michigan, Ann Arbor with specialization in Mathematical Statistics. Received the First D.Sc. from the Indian Statistical Institute in 1975. Served on the Faculties of the University of Michigan, and McGill University, 1959-1964. Visiting Professor at the University of Wisconsin, and University of New South Wales. Distinguished Visiting Scientist, Institute of Ecosystem Studies, New York Botanical Garden. Visiting Professor of Biostatistics, Harvard School of Public Health and Dana-Farber Cancer Institute, Harvard University, 1986-88. Professor of Mathematical Statistics at the Pennsylvania State University, University Park in the Department of Statistics and the Graduate Ecology Program, 1965-1990. At present, Distinguished Professor of Mathematical Statistics and Director, Center for Statistical Ecology and Environmental Statistics in the Department of Statistics at Penn State.

9. Has more than hundred graduate students and interns trained at the home base in statistics, ecology, and the environment. Several of them now hold prestigious positions in academia, agencies, and industries. He is an insightful mentor and a lively guide. He is an extremely inspiring and stimulating instructor in the classroom, whether graduate or undergraduate. He has been the founder chair of the Penn State Graduate Statistics program and of the Penn State graduate Environmental Statistics Program in Statistics. He has been a founder and leader in the Penn State Graduate Program in Quantitative Ecology in the Intercollege Graduate Program in Ecology. An international research journal recently published a special silver jubilee issue for the Penn State Statistical Ecology and Environmental Statistics program and its Center for Statistical Ecology and Environmental Statistics. The invited article specially prepared by five graduate students in his twenty-five year econometrics class is an impressive reflection of the innovative interdisciplinary approach of the instructor for productive crossdisciplinary and disciplinary content and the skill. A steady stream of international research fellows have been visiting scholars and graduate interns with him in statistical ecology and environmental statistics at the Center.

10. The Penn State national center initiative under the direction and leadership of Professor Patil brought together several outstanding colleagues and friends devoted to the cause of statistics, ecology, and the environment having magic to their name at the national and international level. It has triggered enlightened push and support in every direction through its synergistic inputs and outputs initiated by the distinguished participants in their own home bases. The NSF, for example, initiated the Long Term Ecological Research (LTER) Program, the EPA initiated the Environmental Monitoring and Assessment Program (EMAP) and has moved to initiate a Bureau of Environmental Statistics (BES), and the USDI has announced the National Biological Survey (NBS).

11. Has served on the United Nations Environment Program Panel on Early Warning of Emerging Environmental Threats with Panel Chair, Mario Molina, Nobel Laureate, and a member of U.S. President's Committee of Advisors on Science and Technology (PCAST), and helped prepare a draft report on the theme of the panel.

11. As Distinguished Lukacs Professor at Bowling Green, put together an innovative Ninth Lukacs Symposium on Frontiers of Environmental and Ecological Statistics for the 21st Century in association with ten leading national and international professional organizations having responsible interest in the synergistic challenges, opportunities and directions for statistics, ecology, environment and society. Participation was select, superb, and synergistic for cross-fertilization. The program layout was unique and transparent. Gave the keynote inaugural address, emphasizing the centrality for the new millennium looking for appropriate COMPASS, Combination of Practicality and Scholarship. Was Master of

Ceremony for the Twentieth Century Distinguished Service Awards for outstanding synergistic development of statistics, ecology, environment, and society in the form of statistical ecology, environmental statistics, environmental and ecological risk assessment or something more broad within the context. The awardees included John Cairns, Jr., Albert Gore, Jr., Mario Molina, G. P. Patil, John Tukey, E. O. Wilson among others.

12. Has been Principal Investigator of an extremely successful four year NSF/EPA cross-disciplinary research project on 'Statistical Approaches to Multiscale Assessment of Landscapes and Watersheds.' Has been invited to give a series of plenary lectures and keynote addresses, and organize thematic sessions at important conventions and congresses in North America, South America, Europe, and Asia on varying methodology topics involving regional policy research using remote imagery, geospatial information, landscape fragmentation, and spectral change detection.

Part 1: Biographical

Full Name: Ganapati Parashuram Patil

Birth Place: Sunasgaon, Maharashtra State, India

Birth Date: February 2, 1934

Marital Status: Married

Wife's Name and Academic Background:

Lalita Ganapati Patil

B.Sc. (Honors): University of Poona (1959)

M.S. (Biology): University of Michigan (1961)

Ph.D. (Botany): McGill University (1969)

M.B.A. (Management): Simmons, Boston (1989)

Children:

P-Four: (1) Parimal, (2) Parag, (3) Pawan, (4) Priya

Ages in arithmetic Progression: 40, 38^{1/2}, 37, 35^{1/2}.

Name lengths monotonic. Names combined in the natural order make a complete poem:

Fragrance (1) of a Flower (2) on a Breeze (3) permeates Love (4).

Parimal (Penn: Biochemistry and Philosophy; Harvard: Philosophy; U. of Chicago: Philosophy of Religions; Harvard: Philosophy and Religious Studies)

Parag (MIT: Electrical Engineering; Oxford: Philosophy and Economics; Johns Hopkins: Medicine and Biomedical Engineering; Duke and Michigan: Neurosurgery)

Pawan (Harvard: Social Studies; Oxford: Political Science; London School of Economics: Developmental Economics; World Bank: Environmental Economics)

Priya (U. of Chicago: Biopsychology; Johns Hopkins: Reproductive Health, HIV and AIDS)

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Hobbies: Flexible and fluid

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Citizenship: USA

Part 2: Academic and Scientific

(1) ACADEMIC RECORD

1. High School Record

Attended the D.S. High School, Bhusawal, during 1942-1949. Passed the Secondary School Certificate Examination, Bombay State, India, in 1949, standing first in the district and fifth in the state, among one hundred thousand candidates, and secured the following prizes and scholarships:

- (1) Dayaram Shivdas Prize for standing first in the school.
- (2) Bhusawal Municipality Special Prize.
- (3) District Education Society's two prizes, one for standing first in mathematics; second for first-rank in district.
- (4) The Chatfield Scholarship (1949-53) and the Donde Scholarship (1949-50) for having stood first among the sons of primary school teachers of Bombay state.

2. College Record

Attended Ferguson College, Poona, Bombay State, from 1949-1953.

2.1 First Year in Science (1949-50). Was awarded Wasanji Laxmidas Scholarship ("Most Promising and Deserving Student").

Influence of P. C. Mahalanobis for me to think of Statistics as a result of his powerful presidential address at the Indian Science Congress in Poona. Mahalanobis is the discoverer of Mahalanobis Distance. A Fellow of Royal Society, UK, he was the first National Planning Chairman and the Statistical Advisor to Prime Minister Nehru. His presidential address was: Statistics has purpose.

Influence of Rabindranath Tagore for me to think of Ecology as a result of his powerful book, Sadhana (Pursuit). The first chapter is: Man and Nature. Rabindranath Tagore is the Indian Nobel Laureate in Literature.

2.2 Intermediate Science (1950-51). First in the First Class with Distinction at the Intermediate Science Examination, 1951, Poona University.

Was awarded the Wrangler Paranjape Scholarship (1951-53) for standing first in mathematics in the Poona University. Shrimant Dajisaheb Booti and Tatyasaheb Patwardhan Prize, Poona University, for standing first in the University.

College Prizes: C. K. Bhatawadekar Prize, R. G. Deshapande Prize, and V. V. Bhide Prize.

2.3 Junior B. Sc. (1951-52). First in the First Class with Distinction at the Junior B. Sc. Examination, 1952, Poona University. University Scholar. Secured the Wrangler Paranjape Mathematics Prize for writing the "best essay" for the competition.

2.4 Senior B. Sc. (1952-53). First in the First Class with Distinction at the B. Sc. Examination, 1953, Poona University. University Scholar. Was awarded the Wrangler Paranjape Prize for standing first in mathematics in the University and M. C. Joshi Prize for standing first.

3. Graduate School Record

University of Poona initiated Graduate Program in Statistics largely to accommodate my interests for statistics at Poona.

3.1 B.Sc. (Honours) Statistics (1953-54). First in First Class with Distinction at the B. Sc. (Honours) Examination, 1954, Poona University. University Scholar. Dakshina Fellow of the Government of Bombay State.

3.2 M. Sc. (Final) Statistics (1954-55). First in the First Class with Distinction M. Sc. (Statistics) Examination, 1955, Poona University. Dakshina Fellow of the Government of Bombay State. Padamji Scholar, University Scholar.

3.3 Associateship of the Indian Statistical Institute (1955-1957): Was awarded the Associateship ("professional doctorate") of the Indian Statistical Institute on submission of a thesis on the problems of statistical inference in discrete distributions. It was a treat to be at the ISI during this time period. It was the silver jubilee year of the ISI. I was very fortunate to benefit first hand from Deming, Haldane, Fisher, Neyman, Kolmogorov, Rao, Shewhart, and Wiener. It was a pleasure to be around the giants.

3.4 M.S. Mathematics (1957-59). At the University of Michigan, Ann Arbor. Had Grade Average "A".

3.5 Ph.D. Mathematics (1957-59). At the University of Michigan, Ann Arbor. Had Grade Average "A". Doctoral Thesis in Mathematical Statistics on Contributions to Estimation in a Class of Discrete Distributions. Committee Chair: Cecil C. Craig, President of Institute of Mathematical Statistics.

4. Degree for Professional Recognition: D. Sc. Statistics (1975)

Award of the first D.Sc. of the Indian Statistical Institute...in recognition of the quality and quantity of published research in theoretical and applied statistics. Referees and Examiners: Oscar Kempthorne, President of Institute of Mathematical Statistics, C. R. Rao, Fellow of Royal Society, UK, and John Tukey, Recipient of Presidential Medal of Science, USA and a member of the National Academy of Sciences, USA.

5. Honorary Doctorate Degree in Biological Sciences (1988)

Award of the first honorary degree by the University of Parma, Parma, Italy in its four hundred year history. Also the first time that a scholar with a Ph.D. in Mathematics and a D.Sc. in Statistics has received an honorary degree in biological sciences. Delivered a special commencement speech on the occasion of the award ceremony. H. A. Hauptman, 1985 Nobel Prize Winner in Chemistry, has received the 1989 honorary degree at Parma. George Andrews, Evan Pugh Professor of Mathematics at Penn State, has received the 1997 honorary degree at Parma.

6. Honorary Doctor of Letters Degree (1989)

The first to an academic scientist in the history of the University of Poona, Poona, India. The award was primarily in recognition of the outstanding pioneering effort to conceptualize statistical ecology as a substantive subject area and initiate as its founder chair the International Statistical Ecology Program of the International Association for Ecology in conjunction with the International Statistical Institute and the International Biometric Society. Delivered a special commencement speech on the occasion of the award ceremony.

(2) RESEARCH AND TEACHING

1. Teaching

Lecturer, Department of Mathematics, University of Michigan (1959-61).

Assistant Professor of Mathematics, Department of Mathematics, McGill University (1961-1963).
Associate Professor of Mathematics, McGill University (1963-1964).

Visiting Professor, Department of Mathematics and Statistics, University of New South Wales (1967).
Visiting Professor, Mathematics Research Center, University of Wisconsin (1970).
Visiting Professor of Biostatistics, Harvard University (1986-1988).
Professor of Mathematical Statistics, Penn State University (1964-1990).
Distinguished Professor of Mathematical Statistics, Penn State University (1990-).
Distinguished Visiting Lukacs Professor of Mathematics and Statistics, Bowling Green (1999).
Visiting Research Professor, Center for Policy Research, India (1998-1999)

2. Doctoral Thesis in Mathematical Statistics at the University of Michigan (1957-1959). "Contributions to estimation in a class of discrete distributions."
3. Consultant to the Electronic Defense Group at the University of Michigan (1959-1961); to the Ordnance Research Laboratory at the Pennsylvania State University (1964-1968). Consulting on Signal Detection Theory.
4. Consultant, Forest Service, USDA. Consultation: Stochastic Models and Sampling Designs for the Forest Insect Populations. 1968-1974.
5. Consultant, National Institutes of Health, DCRT, LAS. Consultation: Characterizations of Probability Distributions. 1969-1977.
6. Consultant, Environmental Protection Agency. Consultation: statistical needs of the Agency. 1974-1978.
7. Consultant, National Marine Fisheries Service. Consultation: Distributions of Fish and Shell-fish. 1977-1979.
8. Consultant, Marine Indices, Brookhaven National Laboratory, 1984-85.
9. Distinguished Visiting Scientist, Institute of Ecosystem Studies, New York Botanical Garden, May 1986.
10. Consultant and Member, NOAA Chesapeake Bay Stock Assessment Committee, 1985-1992.
11. Consulting Member, EPA Region II New York, Biomonitoring and Ecosystems Objectives, Working Groups, 1991- .
12. Consultant and Member, Statistics Panel, Shrimp Fishery By Catch Program, the Gulf and South Atlantic Fisheries Development Foundation, 1991-1992.
13. Principal Investigator, Co-operative Research, Pennsylvania Department of Environmental Resources, 1991-1993.
14. Principal Investigator: Co-operative Research, U.S. Forest Service, 1968-1974.
15. Principal Investigator: Co-operative Research, National Marine Fisheries Service, 1976-1988.

16. Principal Investigator: Co-operative Research, U.S. Environmental Protection Agency, 1988-
17. Principal Investigator: Multi-scale Assessment Research, National Science Foundation, 1995-98.
18. Principal Investigator: Benchmark Dose Methods, U.S. Environmental Protection Agency, 1997-1999.
19. Principal Investigator: Landscape Approach for Map of Italian Nature, Office of Italian Prime Minister, University of Parma, Italy, 1999-2000.
20. Principal Investigator: Research and Training Grants: Ford Foundation, Forest Service, NSF, MSSB, NATO, EPA, FWS, ARO, NOAA, ORNL, AFOSR, NIH, ONR, etc.
21. Consultant and Member, Peer Review Panel, Ecosystems Indicators Grant Program, U. S. Environmental Protection Agency, 1997.
22. Consultant and Member, Peer Review Panel, Drinking Water Regulation Development Guidance, U. S. Environmental Protection Agency, 1997.
23. Consultant and Member, Peer Review Panel, Fish and Wildlife Consumption Surveys Guidance for Federal Action Plan, U. S. Environmental Protection Agency, 1997.
24. Member, Review Panel, Graduate Environmental Study Fellowship on Terrestrial Ecology and Ecosystems, U. S. Environmental Protection Agency, Washington, DC, February 1998.
25. Member, Review Panel, Graduate Environmental Study Fellowship on Terrestrial Ecology and Ecosystems, U. S. Environmental Protection Agency, Washington, DC, February 1999.
26. Member, Advisory Panel, Cooperative Agreement between The George Washington University and the U. S. Environmental Protection Agency's Office of Water, 1999— .
27. Member, Peer Review Panel, STAR Grants competition on Futures Research in Sustainability and Regional Scale Assessments, U. S. Environmental Protection Agency, Washington, DC, September 2000.
28. Member, , Review Panel, Graduate Environmental Study Fellowship on Terrestrial Ecology and Ecosystems, U. S. Environmental Protection Agency, Washington, DC, February 2001.
29. Member, Futures Panel, International Environmetrics Society, August 2001—
30. Member, EPA Fellowship Review Panel, March 2002.
31. Member, EPA Peer Review Panel for Estimates of Soil Ingestion in Children: The Importance of Measurement Error and Variance Components, August 2002.
32. Member, EPA Peer Review Panel for 'Measurement, Modeling, and Analysis Methods for Airborne Carbonaceous Fine Particulate Matter,' May 2003.

(3) PROFESSIONAL LEADERSHIP

1. Conceived and organized the First International Symposium on Classical and Contagious Discrete Distributions in 1963 at McGill University.
2. Program Chairman for Biometric Society at AAAS, 1968. Conceived and organized the Symposium on Random Counts in Scientific Work.
3. Conceived and organized, as Director and Program Co-Chairman (with E. C. Pielou and W. E. Waters), the First International Symposium on Statistical Ecology in 1969 at Yale University.
4. Organizer and Chairman for the Session on Statistical Ecology at the International Statistical Institute in Washington, D. C., 1971.
5. Member of the Program committees for the 1971 Spring Meetings of the Biometric Society, ENAR and the Institute of Mathematical Statistics.
6. Chairman of the Statistical Ecology Section of the International Association of Ecology, 1969-82. Initiated Advanced Institutes on Statistical Ecology around the world. Director of the First Advanced Institute on Statistical Ecology in the United States in 1972.
7. Conceived and organized, as Director and a Scientific Director (with S. Kotz and J. K. Ord), the NATO Advanced Study Institute on Statistical Distributions in Scientific Work and the International Conference on Characterizations in 1974 at Calgary, Canada.
8. Chairman of the International Statistical Ecology Program initiated by the International Statistical Institute, Biometric Society and the International Association of Ecology.
9. Advisor, EPA Statistics Review Committee (1974).
10. Member, Planning and Organizing Committee, Institute of Quantitative Sciences, Government of Maharashtra, Bombay, India. (1969-1976).
11. Visiting Lecturer, Visiting Lecturer Program in Statistics of the Committee of Presidents of Statistical Societies.
12. Invited Lecturer, NATO Scientific Affairs Division, Marine Science Panel, October 1977.
13. Director and Scientific Director of the Advanced Institute on Statistical Modeling and Sampling for Ecological Abundance, Diversity and Biomonitoring, August 1977, Texas A&M University and University of California, Berkeley.
14. A member of the Editorial Board of Biosciences Communications, and International Journal of Communications Research and Theory in the Biosciences. 1975-1977.
15. Congress Convener for Statistical Ecology, Second International Ecological Congress, Jerusalem, Israel, September 1978. Director and Scientific Director, Satellite Program in Statistical Ecology.
16. A member of the Editorial Board of the International Journal of Ecology and Environmental Sciences: Ecometrics Section.

17. Organizer and Chairman for the Session on Research Training in Statistical Distributions in Scientific Work for the Nineteen-eighties at the American Statistical Association Annual Meeting in Boston, August 1976.
18. Organizer and Chairman of the Statistical Ecology Session at the International Statistical Institute Meetings in Manila, Philippines, December, 1979.
19. Chairman, Committee on Statistical Distributions in Scientific Work. Advanced Study Institute and Research Workshop on Modern Statistical Distribution Theory and Its Applications, Trieste, Italy, July 1980.
20. Organizer and Chairman for the Session on Designing Environmental Impact Studies at the American Statistical Association Annual Meeting in Detroit, August 1981.
21. Founding Member, Committee on Statistics in Wildlife and Fisheries Research, Biometrics Section, American Statistical Association. 1980.
22. Congress Convener for Statistical Ecology, Third International Congress of Ecology, Warsaw, Poland. September 1982.
23. Member, Committee on Statistics and Environment, American Statistical Association, Washington, D.C. 1983-1990.
24. Founding Member and Sponsor, Society for Risk Analysis, 1981.
25. Member, Committee on Special Projects, Society for Risk Analysis, 1983-1985.
26. Member, Program Committee, Society for Risk Analysis, Washington, D.C., 1984.
27. Member, Steering Committee, Eighth Symposium on Statistics, Law and the Environment at the National Academy of Sciences, 1984.
28. Chairman of the Sub-Committee on Forestry and Fisheries of the Steering Committee of the 8th Symposium on Statistics and the Environment, 1984.
29. Chairman of the Organizing Committee (with C. R. Rao and M. Zelen) of the Advanced Research Conference on Weighted Distributions and Related Weighted Methods, Amsterdam, University Park, New Delhi and Syracuse. 1985-86.
30. Principal Lecturer, NSF-CBMS Regional Research Conference on Mathematical Stochastics of Species Abundance and Community Composition, Oklahoma State University, Stillwater, Ok. March 1986.
31. Director, 1986 Satellite Program in Statistical Ecology, International Association for Ecology. Research Workshops, Round Table Discussions, Short Courses, and Seminars. Fourth International Congress of Ecology, Syracuse, NY.
32. Member, Steering Committee, Ninth Symposium on Statistics and the Environment, Risk

Assessment and Public Policy at the National Academy of Sciences, 1986.

33. Member, Program Committee, Oceans 86, Special Symposium on U.S. National Monitoring Strategies, Washington, D.C., 1986.
34. Chairman and Organizer of the Session on Crystal Cube for Coastal and Estuarine Degradation at Oceans 86 (with R. C. Hennemuth and L. Rugolo), Washington, D.C., 1986.
35. Chairman and Organizer of the Session on Encountered (Historical) Data at Oceans 86 (with N. P. Ross), Washington, D.C., 1986.
36. Member, Advisory Committee for a Research Formulation Program on Environmental Health Risk Assessment, Electric Power Research Institute, Palo Alto, 1982.
37. Member, Advisory Committee for a Research Program on Indoor Radon Exposure Assessment, Gas Research Institute, Chicago, 1982.
38. Member, EPA-ASA Peer Review Committee on Acid Deposition, 1984-85.
39. Board Member, International Center for Theoretical and Applied Ecology, Trieste, Italy, 1987- .
40. Organizer of the Session on Meta-Analysis at Spring Statistics Meetings, Boston, 1988. (Speakers to include Fred Mosteller and Ingram Olkin.)
41. Vice Chairman, Scientific Program Committee, International Conference on Biomathematics, Xi'an, China, 1988.
42. Vice Chairman, International Workshop on Statistical Ecology and its Applications in Fisheries, Wuxi, China, 1988.
43. Member, Peer Review Panel, EPA EMSL Spatial Statistics Research Program, Las Vegas, Nevada, 1988.
44. Member, Peer Review Panel, DOE Health and Ecological Research Division, Theoretical Ecology Research Program, Albuquerque, New Mexico, 1989.
45. Founder Member and Sponsor, Statistical Ecology Section, Ecological Society of America, 1986-89.
46. Co-Chairman with Shiro Kobayashi for the Statistical Ecology Symposium at the International Congress of Ecology, Japan, 1990.
47. Co-Chairman with Herbert Lacayo for the EPA Workshop on Superfund Hazardous Waste Sites Characterization and Remediation Statistical Issues and Approaches, Washington, D.C., February 1990.
48. Invited Member, Risk Assessment Guidance for Superfund Workshop on Methods to Estimate Long-Term Exposure to Contaminated Soils at Superfund Sites, U.S. EPA, Washington, DC, February 1990.
49. First ASA Statistics and Environment Section Program Chairman, Annual ASA Meetings, Anaheim, CA, August 1990.

50. Member, Advisory Board, International Triennial Calcutta Symposium on Probability and Statistics, December 1990-.
51. Organizer of the Session on Superfund Site Characterization Statistics at the ASA Winter Conference, New Orleans, January 3-5, 1991.
52. Invited Instructor with Marilyn Boswell of the Tutorial Short Course on Theory and Application of Composite Sampling in Environmental Work at the ASA Winter Conference, New Orleans, January 1991.
53. Invited Instructor with S. D. Gore, A. K. Sinha, S. Talwalker, and C. Taillie for a Short Course on Environmental Sampling and Statistical Modeling at the Eighth Annual EPA Conference on Statistics, Philadelphia, March 1992.
54. Co-Chairman with N. Phillip Ross for the Environmental Statistics Part of the Seventh International Conference on Multivariate Analysis, University Park, PA, May 1992. (C. R. Rao, Chairman and Organizer).
55. Co-Chairman with G. D. Johnson for the PA DER Workshop on Composite Sampling and Rank Set Sampling for Site Characterization and Evaluation, State College, PA, June 1992.
56. Invited Chairman and Moderator for Environmental Statistics Part of the International Conference on Quantitative Methods in Applied Sciences held as a part of the Celebration of the 750th Anniversary of the University of Siena and the Inaugural of a new Department of Quantitative Methods in the University, Siena, June 1992.
57. Invited Member of the Scientific Program Committee and the Session Chair for Statistical Ecology and Environmental Statistics, Eco-Inforna 1992, 2nd International Congress and Exhibition on Environmental Information and Communication, Bayreuth, Germany, September 1992.
58. Invited Participant and Keynote Speaker on Approaches to Address Data Quality Related to Ecological Effects and Exposure at the Life Cycle Assessment Data Quality Workshop, Society of Environmental Toxicology and Chemistry, Wintergreen, VA, October 1992.
59. Chairman, Distinguished Statistical Ecologist Award Committee, Statistical Ecology Section of the International Association for Ecology, 1992-1994.
60. Convenor, Working Group on Composite Sampling in Theory and Practice. 1992-
61. Invited Instructor for a Short Course on Environmental Sampling at the II Reunion de Estadistica y Medio Ambiente, Hermosillo, Mexico, May 1993.
62. Invited Instructor of a Short Course on Environmental Sampling, Statistical Modeling, and Observational Economy at the International Statistical Institute Satellite Meeting on Sampling Methods, Padova, Italy, August 1993.
63. Member, Scientific Committee with Nick Fisher as Chair, Chemometrics and Environmetrics Meeting, Satellite Meeting to the 49th ISI Session, Bologna, Italy. August 1993.

64. Chairman and Moderator, Panel Discussion Session on Environmental Statistics for Year 2000: Directions and Needs, Chemometrics and Environmetrics Meeting, Bologna, Italy. August 1993.
65. Chairman, Session on Environmental Sampling and Observational Economy, Chemometrics and Environmetrics Meeting, Bologna, Italy. August 1993.
66. Invited Instructor, Short Satellite Course on Environmental Sampling, Statistical Modeling and Observational Economy, International Association of Sample Surveys, Univ. Degli Studi di Padova, Padova, Italy. August 1993.
67. Chairman, Ecological Risk Assessment Statistical Issues and Methods Committee and Member, Program Planning Committee, ASA Conference on Statistical Issues and Methods for Environmental Risk Assessment, Washington, DC, September 1993.
68. United States Delegate, NAFTA Trilateral Meeting for Environmental Information and Reporting, Mexico City, October 1993.
69. Invited Member of the International Organizing Committee of the Mahalanobis Birth Centenary Celebration Conference on Environmental Problems, Issues, Statistical Models and Methods, Indian Statistical Institute, Calcutta, India, December 1993.
70. Member, Steering Committee, International Conference on Cost-Efficient Acquisition and Utilization of Data in the Management of Hazardous Waste Sites, the Air and Waste Management Association, Washington, DC. March 1994.
71. Organizer, Session on Design and Sampling Issues in Ecology, ENAR Spring Meeting, Cleveland, Ohio. April 1994.
72. Organizer and Chairman of the Scientific Program Committee, Frontiers of Statistical Ecology and Environmental Statistics, Silver Jubilee of Statistical Ecology at the Sixth International Congress of Ecology, International Association for Ecology, Manchester, UK, August 1994.
73. Organizer, Session on Frontiers of Statistical Ecology and Related Ecological Statistics, Joint Statistics Meetings, Toronto, August 1994.
74. Organizer with Larry Cox of EPA and with Jerry Sacks of NISS, Workshop on Spatial Sampling for the Environment, University of North Carolina, Chapel Hill, NC. September 1994.
75. Moderator, Inter-Agency Workshop on Environmental Monitoring and Assessment, Chapel Hill, NC, March 1995.
76. Organizer, Session on Biodiversity, Geographic Information, and Statistics, Interface '95, 27th Symposium on the Interface: Computing Science and Statistics, Pittsburgh, PA. June 1995.
77. Member, Program Committee, INTERFACE 95, Statistics and Manufacturing in Environmental Statistics, Graphics, and Imaging, Pittsburgh, PA, June 1995.
78. Vice President, ISEM 95: Ecological Modelling Progress to Meet the Challenge of Sustainable

Development, Beijing, China, August 1995.

79. United States Delegate, NAFTA Bi-National Workshop on Baseline Indicators for the U.S.-Mexico Border, San Diego, CA, September 1995.

80. Member, Executive Committee, SPRUCE III , Statistical Aspects of Pollution: Assessment and Control, Merida, Yucatan, Mexico, December 1995.

81. Member, EPA National Environmental Partnership Planning System (NEPPS), 1996-1998.

82. Organizer, Session on Ecological Applications of Generalized Linear Models and Quasi-Likelihood Methods, ENAR Spring Meeting, Richmond, VA, March 1996.

83. Member, Science Advisory Board, Spatial Accuracy Assessment in Natural Resources and Environmental Sciences, USFS International Symposium, Colorado State University, May 1996.

84. Member, International Union of Geological Sciences Working Group on Ecology in the Commission on Geological Sciences for Environmental Planning of IUGS, January 1996-- .

85. Invited Participant in the Harvard Award Ceremony for Marvin Zelen Leadership Award in Statistical Science to Frederick Mosteller and the Weekend Retreat.

86. Member, Peer Review Panel Meeting, Ecosystem Indicators Grant Program, U. S. Environmental Protection Agency, June 1997.

87. Organizer and Chair, session on Environmental Sampling, Observational Economy, and Ecological Modeling, International Conference on Combinatorics, Information Theory and Statistics Portland, Maine, July 1997.

88. Organizer, session on Statistical Multiscale Assessment of Landscapes and Watersheds, International Conference on Combinatorics, Information Theory and Statistics, Portland, Maine, July 1997.

89. Member, Review Panel, Graduate Environmental Study Fellowship on Terrestrial Ecology and Ecosystems, Washington, DC, February 1998.

90. Convener, Statistical Ecology Group, International Association for Ecology, Frontiers of Statistical Ecology with Environmental Statistics for Cost-Effective Ecological Synthesis and Environmental Analysis, Seventh International Congress of Ecology, Florence, Italy, July 1998.

91. Workshop chair and instructor, 'Multi-Scale Approaches to Critical-Area Analysis and Modeling of Watersheds and Landscapes: Case Studies, Issues, and Examples,' Workshop on Quantitative Analysis of Territorial Geospatial Data: Multiscale Ecological Assessment and Sampling Design, Florence, Italy, July 1998.

92. Organizer, 'Frontiers of Statistical Ecology with Environmental Statistics for Cost-Effective Ecological Synthesis and Environmental Analysis,' Seventh International Congress of Ecology, Florence, Italy, July, 1998

93. Organizer, Symposium on Statistical Methods for Spatial Data Analysis in Ecology, Seventh

International Congress of Ecology Florence, Italy, July, 1998.

94. Organizer, Distinguished Statistical Ecologist Awards Ceremony and the Panel Discussion on the 20th Century Statistical Ecology With a View to the 21st Century: Frontiers of Cost Effective Ecological Synthesis and Environmental Analysis Seventh International Congress of Ecology Florence, Italy, July, 1998.

95. Chair, Workshop on Quantitative Analysis of Territorial Geospatial Data: Multiscale Ecological Assessment and Sampling Design, Florence, Italy, July 1998.

96. Organizer and Chair, Session on 'Statistical Multiscale Assessment of Landscapes and Watersheds with Satellite and Synoptic Data,' Joint Statistical Meetings, Dallas, Texas, August 1998.

97. Organizer, Session on 'Environmental Statistics,' International Indian Statistical Association Meeting, McMaster University, Canada, October 1998.

98. Convener, Planning and Organization Meeting, Consortium Initiative on Policy Research with 21st Century Technology, Regional Policy Research with Remote Imagery and Geospatial Information, New Delhi, India, December ,1998

99. Member, Panel, UNEP Division of Environmental Information, Assessment, and Early Warning, North America, Panel Meeting, Washington, DC, December 1998. Nobel Laureate, Mario Molina in Chair.

100. Organizer, Session on 'Spatial Analysis in Ecology: Statistical Analysis of Remote Imagery in Landscape Ecology I, 1999 Annual Meeting, Association of American Geographers, Honolulu, Hawaii, March 1999.

101. Organizer, Session on 'Spatial Analysis in Ecology: Statistical Analysis of Remote Imagery in Landscape Ecology II, 1999 Annual Meeting, Association of American Geographers, Honolulu, Hawaii, March 1999.

102. Convener, Ninth Lukacs Symposium 'Frontiers of Environmental and Ecological Statistics for the 21st Century: Synergistic Challenges, Opportunities and Directions for Statistics, Ecology, Environment, and Society,' Bowling Green State University, Bowling Green, Ohio, April 1999.

103. Invited member of the Panel, EPA Conference on Environmental Statistics and Information, EPA's Vision for the 21st Century, 13th Annual EPA Conference on Statistics and Information, Philadelphia, PA, May 1999

104. Organizer and Chair, Invited Paper Meeting 'Landscape and Watershed Frontier of Environmental and Ecological Statistics with Remote Sensing Data,' 52nd ISI Session, Helsinki, Finland, August 1999.

105. Instructor, Short Course, 'Environmental and Ecological Regional Policy Research with Remote Imagery and Geospatial Information,' 44th Biometric Meeting of the Brazilian Region of the International Biometric Society, Botucatu, Sao Paulo, Brazil, July 1999.

106. Organizer and Chair, 'Landscape Health Assessment Using Remote Imagery, Geospatial Information, and Landscape Fragmentation,' Managing for Ecosystem Health, International Congress on

Ecosystem Health, Sacramento, CA, August 1999.

107. Member, International Organizing Committee, 'Managing for Ecosystem Health,' International Congress on Ecosystem Health, Sacramento, CA, August 1999.

108. Instructor, Short Course, 'Landscape Approach to Environmental and Ecological Assessment Using Multiscale Statistical Concepts and Methods,' National Convention for Statistics and the Environment, La Plata, Argentina, October 1999.

109. Member, Special Science Advisory Panel on 'The Human Environment Index: A Tool for Measuring the Human Impact on the Environment,' UNEP with panel Chair Mario Molina, Nobel Laureate and member, U.S. President's Committee of Advisors on Science and Technology.

110. Member, Special Panel of the United Nations Industrial Development Organization at the International Center for Science and Technology in Trieste, Italy during September, 2000 to advise on the Proposed International Research and Training Program on Landscape Patterns Analysis for Sustainable Environment and Development.

111. Chief Guest, First Environmental Statistics Day, National Statistical Society, Slovenia, September 2000.

112. Organizer and Chair, Plenary Program at the Index-2001-Congress, Rome, Italy, October 2001.

113. Chair, Plenary International Panel Discussion on Twenty-First Century Man Environment Interface Assessment Issues and Initiatives Using Twenty-First Century Techniques and Tools, Index-2001-Congress, Rome, Italy, October 2001.

114. Organizer and Chair, Session on Ecosystem Health and Its Measurement at Landscape Scale, ISEH Conference on Linkages Between Biodiversity, Ecosystem Health, and Human Health, Washington, DC, June 2002.

115. Organizer, Session on Ecosystem Health and Its Measurement at Landscape Scale, The International Environmetrics Society Meetings, Genoa, Italy, June 2002.

116. Invited Instructor for Short Course on 'Multiscale Advanced Raster Map Analysis Instruction Methods and Tools,' Map of Italian Nature Program, Parma, Italy, June 2002.

117. Organizer and Chair, Special Invited Session on Multiscale Advanced Raster Map Analysis System for Digital Government in the 21st Century, Joint Statistical Meetings, New York City August 2002.

118. Invited Member of the Evaluation Panel of Government of Sweden MISTRA Program on Remote Sensing for the Environment, Stockholm, Sweden, November 2002-- .

119. Organizer and Chair, Special Invited Session on Hotspot Detection, Delineation, and Prioritization for Geographic Surveillance and Early Warning System, Joint Statistical Meetings, San Francisco, August 2003.

120. Organizer and Chair, Birds of a Feather Session, "IT Research and Collaboration Tools: Geoinformatic Surveillance: Hotspot Detection and Prioritization Across Geographic Regions and Networks for Digital Government in the 21st Century," National Conference on Digital Government Research, Boston, MA, May

2003.

121. Member, Editorial Board, Ecohealth, Springer-Verlag, New York, 2004—2008.

122. Member, “Technical Committee on Intelligence and Security Informatics in Transportation Systems (TCISI)” of IEEE Intelligent Transportation Systems Council (ITSC), 2004— .

123. Organizer and Chair, Special Invited Session on Statistical Geographic Surveillance and Security, Joint Statistical Meetings, Toronto, Canada, August 2004.

124. Organizer, Forum for Statistical Ecology, Environmental Statistics, Multiscale Advanced Raster Map Analysis, and Surveillance Geoinformatics, International Conference on Future of Statistical Theory, Practice, and Education, Hyderabad, India, December 2004-January 2005.

125. Member, Program Committee, International Conference on Intelligence and Security Informatics, 2005.

126. Member, United States Environmental Protection Agency, Science Advisory Board, Regional Vulnerability Assessment Panel, to review the USEPA ReVA Program, 2004-2005.

127. Member, Program Committee for the Birth Centenary celebration of the Famous Italian duo Gini and Lorenz, 2004-2005.

128. Organizer and Chair, and Invited Speaker: Session on Biosurveillance GeoInformatics for Biosecurity. Organizer and Chair: Luncheon Round Table on Biostatistics and Biometrics for Biosurveillance and Biosecurity Applications. ENAR Spring Meeting, Austin, TX, March 2005

129. Organizer and Chair: Invited Paper Session on Ranked Set Sampling – 50 years. International Statistical Institute, Sidney, Australia, April 2005.

130. Organizer and Chair, and Invited Speaker: Session on Statistical GeoInformatics for Human Environment Interface in the mid-Atlantic Region of the United States. Joint Statistical Meetings, Minneapolis, MN, August 2005.

131. Organizer, Chair, and Invited Speaker: Session on Multiscale Advanced Raster Map Analysis for Ecosystem Health Monitoring, Assessment, and Management in the 21st Century. International Ecological Congress, Montreal, Canada, August 2005.

132. Organizer and Chair: Session on Environmental Statistics and Surveillance GeoInformatics; Plenary Lecture: Hotspot GeoInformatics for Monitoring, Etiology, Early Warning, and Management for Digital Governance in the 21st Century. International Conference on Statistics in the Technological Age, Kuala Lumpur, Malaysia, December 2005.

133. Course Instructor and Workshop Leader for Short Course and Case Studies Workshops on “Geoinformatics of Hotspot Detection and Prioritization for Monitoring, Etiology, Early Warning and Management Around the World.”

Honolulu, Hawaii, March 7-11, 2005

Siena, Italy, October 13-14, 2005

Okayama, Japan, November 19, 2005

Bangkok, Thailand, November 30, 2005
Jakarta, Indonesia, November 25, 2005
Hyderabad, India, December 24-25, 2005
Kuala Lumpur, Malaysia, December 27, 2005

134. Course Instructor and Workshop Leader for Short Course and Case Studies Workshops on “Geoinformatics of Hotspot Detection and Prioritization for Monitoring, Etiology, Early Warning and Management Around the World”
Parma, Italy (March 30-31, 2006; October 1, 2006)
San Diego, USA (May 21-24, 2006)
Jalgaon, India (December 11-22, 2006)
New Delhi, India (December 26, 2006)
Bogor, Indonesia (December 27-30, 2006)

(4) INVITED PAPERS

1. International Congress of Mathematicians, Stockholm, 1962.
2. International Statistical Institute, Ottawa, 1963.
3. International Symposium on Discrete Distributions, Montreal, 1963.*
4. International Statistical Institute, Belgrade, 1965.
5. International Congress of Mathematicians, Moscow, 1966.*
6. Statistical Ecology Symposium, AAAS, Washington, 1966.*
7. International Symposium on Operations Research, New Delhi, 1967.
8. International Biometric Conference, Sydney, 1967.
9. International Statistical Institute, Sydney, 1967.
10. Symposium on Random Counts in Scientific Work, AAAS, Dallas, 1968.
11. International Symposium on Statistical Ecology, New Haven, 1969.*
12. International Statistical Institute, London, 1969.
13. Indian Science Congress. Special Address to the Statistics Section, Kharagpur, 1970.
14. International Statistical Institute, Washington, 1971.*
15. International Statistical Institute, Vienna, 1973.
16. NATO Advanced Study Institute on Statistical Distributions in Scientific Work, Calgary, 1974.*
17. International Conference on Characterizations of Statistical Distributions, Calgary, 1974.*
18. Symposium on Recent Trends of Research in Statistics: An International Conference in memory of P.C. Mahalanobis, Calcutta, 1974.
19. N.S.F. Regional Research Conference on Recent Developments in the Theory of Sampling and its Applications. Also served on the Panel for the Workshops. University of South Carolina, Charleston, South Carolina. August 1975.
20. Conference on the Theory and Applications of Reliability with emphasis on Bayesian and Nonparametric Methods, University of South Florida, Tampa, Florida, December 1975.
21. International Biometric Conference, Boston, August 1976.
22. Satellite A in Statistical Ecology, College Station and Berkeley, August 1977.*
23. International Statistical Institute, New Delhi, India. December 1977.
24. International Conference on Optimizations in Statistics, Bombay, India. December 1977.*
25. Satellite B in Statistical Ecology, Parma, Italy, August 1978.*
26. Satellite C in Statistical Ecology, Jerusalem, Israel, September 1978.*
27. International Council for the Exploration of the Sea, Copenhagen, Denmark, October 1978. (Co-authored paper presented by a colleague).

28. Advanced Concepts in Ocean Measurements, Baruch Institute in Marine Biology, ONR Symposium, Georgetown, South Carolina. October 1978.*
29. International Council for the Exploration of the Sea, Warsaw, Poland, October 1979. (Co-authored paper presented by a colleague.
30. International Statistical Institute, Manila, Philippines. December 1979.*
31. Participant and a Group Chairman, Co-operative Agreement (PSU and EPA) for the Evaluation of Current Environmental Research and Establishment of Priorities. Final Report October 1, 1979.
32. Joint Meeting of the American Society of Zoologists and the American Microscopical Society, Symposium on the Use of Artificial Substrates in Aquatic Community Structures and Functional Analyses, December 1980 (unable to attend).
33. Presidential Invited Address, Biometric Society ENAR Spring Meetings, March 1980.
34. International Summer School on Statistical Distributions, University of Trieste, Trieste, Italy, July 1980.*
35. First Congress of Italian Ecological Society, Italy, October 1980. Opening Address on Quantitative Ecology entitled, Some Perspectives in Statistical Ecology.
36. ENAR and ASA Meetings, Richmond, Virginia, March 1981. "Weighted Distributions and Size Biased Sampling with Applications."
37. ASA Meetings, Detroit, Michigan, August 1981. "Statistical Analysis of Recruitment Data for Eighteen Marine Fish Stocks." (With C. Taillie).
38. ASA Meetings, Detroit, Michigan, August 1981. "Harvesting and Predation in Stochastic Population Models." (With Brian Dennis).
39. Guest of the South African Statistical Association, November 1981. Gave inaugural and final keynote addresses to the Annual Conference on South African Statistical Association. "Some Perspectives in Statistical Ecology" and "Weighted Distributions and Applications."
40. Indian Statistical Institute Golden Jubilee, December 1981. "Studies in Statistical Ecology Involving Weighted Distributions."
41. A panelist for the panel discussion on Exploring Liberating Components of General Education, Penn State General Education Conference, May 1982. A joint paper with William Toombs on Integrative Thinking and Coping with Uncertainty.
42. Inaugural keynote address for the American Society of Testing Materials Symposium on Statistics in Environmental Sciences, Philadelphia, October 1982.
43. Moderator, Panel Discussion on a Proposed Co-operative Program on Statistical Ecology and Environmental Statistics for Increased Resource Productivity and Environmental Protection, ASTM Symposium, October 1982.
44. ASA Meetings, Toronto, Canada, August 1983. "Quantitative Risk Analysis in Ecological Research and Management with a Pragmatic Example in Georges Bank Haddock Fishery." (With Bradford Brown).
45. ASA Meetings, Toronto, Canada, August 1983. Leader of the Round Table Discussion on "Coping with Uncertainty with Secular Parables and Pictures."*
46. A Position Paper in the Plenary Session for Panel Discussion on "Implementing Statistical Ecology Initiatives to Cope with Global Resource Impacts," at the International Conference on Renewable Resource Renewable Resource Inventories for Monitoring Changes and Trends, Corvallis, Oregon, August 1983. (With Richard Hennemuth).*
47. Impact Assessment, and Risk Analysis, Les Arcs, France, August 1983. "A Perspective of Quantitative Risk Analysis in Ecological Work."
48. Invited Discussant, Symposium on Quantitative Environmental Risk Assessment, Joint AIBS and ESA Meetings, Fort Collins, Colorado, August 1985.
49. Inaugural Keynote Speech, Advanced Research Conference on Observational Studies, Encountered Data Analysis, Representativeness Issues, and Weighted Distributions: Amsterdam,

University Park, New Delhi, 1985.

50. Invited Plenary Lecture on Statistical Ecology, International Association for Ecology at the 4th International Congress of Ecology, Syracuse, NY, August 1986.

51. Invited Paper, "Bivariate weighted distributions and their applications in biological studies," ASA, Las Vegas, August '85.

52. Invited Papers, "A scientific perspective of the statistical ecology initiatives program for resource productivity and environmental management," and "Modelling and analysis of recruitment distributions of selected marine fish stocks," AIBS Meeting, Gainesville, Fla., August 1985, -Organizer of Sessions on Statistical Models in Ecology at AIBS Meeting.

53. Invited Paper, "Can we design encounters?" ICES Meeting in London, October '85.

54. Special Invited Paper, "Multivariate encountered data and weighted distributions methodology," Calcutta, International Conference on Multivariate Analysis.

55. Plenary Lecture, "Encountered data, representativeness issues, and weighted distributions," New Delhi, India, January 1986, Indian Science Congress.

56. International seminars on statistical ecology, University of Poona, India: a) Inaugural lecture; and b) three special lectures. 1986.

57. Invited Discussant, ASA/EPA Conference on Combined Toxicant Effects, Washington, D.C., April 1986.

58. Invited Panelist, EPA Research Workshop on Chemometrics and Application of Multivariate Statistics to Complex Chemical and Human Health Data, Las Vegas, Nevada, June 1986.*

59. Invited Paper, ASA/EPA Conference on Statistical Issues in Combining Environmental Studies, Washington, D.C., October 1986.

60. Invited Paper, Oceans 86 Special EPA/NOAA Symposium on U.S. National Monitoring Strategies, Washington, D.C., September 1986.

61. Invited Lecturer, International Course on Advanced Mathematical Ecology, Center for Theoretical Physics, Trieste, Italy, December 1986.

62. Principal Lecturer, Italian Ecological Society Research Workshop on Statistical Ecology and Environmental Statistics, Parma, Italy, December 1986.

63. Invited Address to the Boston Chapter of ASA on Encountered Data and Representativeness Issues, M.I.T., Cambridge, March 1987.

64. Invited Speaker, Symposium on Dependence in Statistics and Probability, (AFOSR, NSF, ARO, and UOP), Hidden Valley Conference Center, Somerset, PA, August 1987.

65. Special Invited General Methodology Lecture-I. Annual Meetings of the American Statistical Association, San Francisco, August 1987.

66. Invited Keynote Address to Italian Ecological Society, Annual Meetings, Siena, Italy, October 1987.

67. Invited by the Chinese Academy in Fisheries Sciences and in Mathematical Sciences with a special international travel award from the Chinese Ministry of Agriculture, Fisheries and Animal Husbandry to give a series of lectures, seminars and workshops in China, 1988.

68. Invited speaker, International Conference on Recent Developments in Statistical Data Analysis and Inference in Honor of C. R. Rao, Neuchatel, Switzerland, 1989.

69. Invited speaker, EPA Environmental Response Branch Workshop on Data Manipulation and Interpretation, Edison, New Jersey, March 1990.

70. Invited speaker, The Sixth Annual EPA Conference on Statistics, Williamsburg, VA, March 1990.*

71. Invited paper, Annual Meetings of the American Statistical Association, Anaheim, CA, August 1990, Statistics and the Environment Section Session on Superfund Hazardous Waste Site Characterization and Remediation Statistics.*

72. Invited address to the Harrisburg Chapter of ASA on Superfund Hazardous Waste Site

Characterization Statistics Issues and Approaches, Harrisburg, PA, May 1990. Member of the panel for a panel discussion.

73. Invited speaker, Fifth Regional Risk Assessment Conference in the Superfund Issues Session, Chicago, IL, June 1990.

74. Chairman and Moderator, Panel Discussion on Challenges and Directions for Statistics and the Environment in the Times Ahead, Annual ASA Statistics Meetings, Anaheim, CA, August 1990.*

75. Leader, Round Table Luncheon Discussion on Superfund Statistics Issues and Approaches, ASA Statistics Meetings, Anaheim, CA., August 1990.

76. Chairman and Moderator, Panel Discussion on Site Evaluation and Characterization, Symposium on Chemometrics with Environmental Applications, Las Vegas, NV, October 1990.*

77. Invited Research Conference Lecturer, Third Autumn Course in Mathematical Ecology, Trieste, Italy, November 1990.

78. Invited speaker on Theory and Application of Composite Sampling in Environmental Work, International Conference on Recent Developments in Probability and Statistics Dedicated to the Memory of Professor C. G. Khatri, New Delhi, India, December 1990.*

79. Invited paper, American Statistical Association 1991 Winter Conference, New Orleans, January 3-5, 1991, on Statistics and the Environment.*

80. Invited speaker, U. S. Department of Energy Statistics Workshop on Planning for DOE Environmental Restoration: Statistics and Decision Analysis, Santa Fe, NM, February 1991.

81. Invited speaker, EPA Seventh Annual Conference on Statistics, Richmond, VA, March 1991.*

82. Invited speaker, First International Triennial Calcutta Symposium on Probability and Statistics, Calcutta, December 1991-January 1992.

83. Invited speaker, International Conference on Statistics in Public Resources and Utilities, and in Care of the Environment (SPRUCE), Lisbon, Portugal, April 1992.

84. Invited speaker, Seventh International Conference on Multivariate Analysis Around the World, University Park, PA, May 1992.*

85. Invited speaker, EPA Eighth Annual Conference on Statistics, Philadelphia, PA, March 1992.*

86. Invited speaker, International Conference on Biodiversity in Managed Landscapes: Theory and Practice, Sacramento, CA, July 1992.

87. Invited Summer Program Participant in Residence, IMA Summer Program on Environmental Studies: Mathematical, Computational, and Statistical Analysis, University of Minnesota, Minneapolis, MN, July 1992.

88. Invited Keynote Address, Annual National Meeting of the American Chemical Society, Symposium on Environmental Statistics, Assessment, and Forecasting, August 1992.

89. Invited speaker, Sixteenth International Biometric Conference, Biometric Society, Hamilton, New Zealand, December 1992.

90. Invited speaker, International Conference on Environmental Biometrics, Sydney, Australia, December 1992.

91. Invited speaker, J.B.S. Haldane Birth Centenary Conference, Indian Statistical Institute, Calcutta, India, December 1992. (Unable to attend).

92. Inaugural Lecture, Mahalanobis Centenary Conference on Multivariate Analysis, Indian Statistical Institute, New Delhi, India, December 1992.

93. Invited speaker, Thematic Meeting on Environmetrics at the 49th Session of the International Statistical Institute, Firenze, Italy, August 1993.

94. Invited speaker, Conference on Measuring and Monitoring Biodiversity in Tropical and Temperate Forests, the International Union of Forest Research Organizations, Chiang Mai, Thailand, August 1994.

95. Keynote Speaker, Frontiers of Statistical Ecology and Ecological Statistics, Silver Jubilee of Statistical Ecology, Sixth International Congress of Ecology, Manchester, UK, August 1994.

96. Banquet Evening Speech, Silver Jubilee of Penn State Statistical Ecology and Environmental Statistics, 225th IMS Special Topics Meeting, University Park, PA. October 1992.
97. Inaugural Lecture, International Conference on Environmental Biometrics, Sydney, Australia, December 1992.
98. Inaugural Lecture, Khandesh Education Society, Jalgaon, India, School Dedication and Felicitiation Ceremony. December 1992.
99. Invited speaker, "Environmental Sampling, Observational Economy, and Extreme Values," Conference on Extreme Value Theory and Its Applications, Gaithersburg, MD, May 1993.
100. Invited Paper, "Environmental Sampling, Observational Economy, and Statistical Inference with Emphasis on Ranked Set Sampling, Encounter Sampling, and Composite Sampling," 49th Session of ISI, Florence, Italy. August-September 1993.
101. Invited Speaker, The Monte Verita Conference on Forest Survey Designs, Monte Verita, Ascona, Switzerland. May 1994.
102. Invited Keynote Speaker, Niort Conference on Ecology and Statistics, Niort, France. Keynote speech on Ecological Monitoring and Assessment Statistics and Design. October 1994.
103. Invited Poster Presentation and Scientific Visualization on Observational Econom Through Ranked Set Sampling, Mid-Atlantic Highland Area Environmental Monitoring and Assessment Conference, Hershey, PA. February 1994.
104. Invited Poster Presentation and Scientific Visualization on Statistical Analysis of Left-Censored Ground-Water Monitoring Data, Mid-Atlantic Highland Area Environmental Monitoring and Assessment Conference, Hershey, PA. February 1994.
105. Invited Paper, "Improved Environmental Statistics and Reporting with Innovative Environmental Resource Sampling and assessment," The Eleventh Annual EPA Conference on Statistics, Williamsburg, VA. March 1995.
106. Invited Paper, "Innovative Environmental Resource Sampling Techniques," 1995 EMAP Symposium on Monitoring, Assessment and Science Policy, Chapel Hill, NC. March 1995.*
107. Inaugural Keynote Address, "Innovative Statistical Mindsets and Novel Observational Approaches to Meet the Challenges of Hazardous Waste Site Management," Conference on Challenges and Innovations in the Management of Hazardous Waste, Washington, DC. May 1995.
108. Invited Plenary Speaker, "Generalized Linear Models with Ecological Applications," First Biometric Society Italian Region Conference, Cortona, Italy. June 1995.
109. Invited Paper, "Estimation of Multiple Characteristics Using Ranked Set Sampling Methods," 50th Session of the International Statistical Institute, Beijing. August 1995. (Unable to attend).
110. Invited Plenary Lecture, "Frontiers of Statistical Ecology and Ecological Statistics: Past, Present, and Future," ISEM 95. International Conference on State of the Art in Ecological Modelling, Beijing China. August 1995. (Unable to attend).
111. Invited Plenary Lecture, "Multiscale Analysis of the Spatial Distribution of Breeding Bird Species Richness Using the Echelon Approach," Monte Verita, Switzerland. October 1996.
112. Invited Plenary Lecture, "Using Covariate-Species Community Dissimilarity to Guide Sampling for Estimating Breeding Bird Species Richness," Monte Verita, Switzerland. October 1996.
113. Invited Banquet Address, "Banquet Address in Honor of C. R. Rao," Conference on Statistical Research in the 21st Century, Montreal, Canada. November 1996.
114. Invited Popular Evening Plenary Lecture, "Statistical Ecology with Environmental Statistics in Statistics, Ecology, Environment and Society: Innovative Mindsets, Novel Tools, and Picturesque Solutions," First Indian Ecology Congress, New Delhi, India. December 1996.
115. Invited Plenary Lecture, "Statistical Ecology, Environmental Statistics, and Ecological Assessment," First Indian Ecology Congress, New Delhi, India. December 1996.
116. Invited Panel Member, Panel Discussion on Cooperative Research Agreements in Environmental Statistics for Environmental Research, The Thirteenth Annual EPA Conference on Statistics, Richmond,

VA, April 1997.

117. Invited paper, “Contemporary Challenges and Recent Advances in Environmental Sampling and Observational Economy,” session on Environmental Sampling, Observational Economy, and Ecological Modeling, International Conference on Combinatorics, Information Theory and Statistics Portland, Maine, July 1997.*

118. Invited Speaker, “Contemporary Challenges and Recent Advances in Environmental Sampling and Observational Economy,” Thematic Meeting on Environmental Sampling, Monitoring, and Assessment at the 51st Session of the International Statistical Institute, Istanbul, Turkey, August 1997.

119. Presented paper, ‘Multi-Scale Statistical Approach to Critical-Area Analysis and Modeling of Watersheds and Landscapes,’ EPA/NSF Partnership For Environmental Research Water and Watersheds Program Review Meeting, Oregon State University, Corvallis, Oregon, January, 1998

120. Keynote inaugural address, ‘Risk Assessment and Management of Environmental Pollution,’ Third National Workshop on Biostatistics and Biometry, Department of Zoology, BHU, Varanasi, India, December 1998.

121. Keynote speaker, 86th Session of the Indian Science Congress Association, ‘New Biosciences: Opportunities and Challenges As We Move Into the Next Millenium,’ Anna University, Chennai, India, January 1999.

122. Keynote inaugural address, Ninth Lukacs Symposium on Frontiers of Environmental and Ecological Statistics for the 21st Century, Bowling Green, Ohio, April 1999.

123. Invited speaker, Colloquium on ‘Conference on Spatial and Environmental Statistics,’ Freiberg, Germany, June 1999.

124. Keynote inaugural address, ‘Environmental Policy Research Using Remote Imagery and Geospatial Information,’ Biometrics Conference, La Plata, Argentina, October 1999.

125. Invited speaker, ‘Landscape health assessment using remote imagery, geospatial information, and multiscale landscape fragmentation,’ Italian Congress of Ecology, Lecce, Italy, September 1999.

126. Invited speaker, ‘On Fitting a Multiscale Hierarchical Generating Model for Thematic Raster Maps for Multiscale Landscape Health Assessment,’ Statistics Section of the Indian Science Congress, Pune, India, January 2000.

127. Invited speaker, ‘Statistical Science and Regional Environmental Policy with Remote Sensing Change Detection and Multiscale Landscape Fragmentation,’ Workshop on Statistical Science and Environmental Policy, Indian Statistical Institute, Calcutta, January 2000.

128. Plenary Lecture, ‘Multiscale Markov transition matrix models for hierarchically scaled landscape patterns using remote sensing data,’ International Conference in honor of C. R. Rao on the occasion of his 80th Birthday, San Antonio, Texas, March 2000.

129. Inaugural Keynote Address, ‘Multiscale advanced raster map analysis for sustainable use of the planet using remote sensing data,’ Annual Meeting of the National Statistical Society, Slovenia, September, 2000.

130. Inaugural Keynote Plenary Lecture, “Multiple Advanced Raster Map Analysis for Sustainable Use of the Planet,” Portuguese Statistical Congress, Ponta Delgada, Portugal, November 2001.

131. Final Keynote Plenary Lecture, “Multiscale advanced raster map analysis for sustainable use of the planet,” Brazilian Ecological Congress, Porto Alegre, Brazil, November 2001.

132. Invited Plenary Lecture, “Multiscale raster map analysis for sustainable environment and development,” International Environmetrics Society Annual Meeting, Portland, OR, August 2001.

133. Invited Plenary Lecture, “Nationwide indicators and their integration, evaluation, and visualization worldwide,” Index-2001-Congress, Rome, Italy, October 2001.

134. Invited Plenary Lecture, “Environmental indicators: comparisons and rankings without integration—Some statistical and visual tools with applications to the proposed Human Environment Index,” Index-2001-Congress, Rome, Italy, October 2001.

135. Invited Plenary Lecture, “Multiscale landscape pattern analysis for assessing ecosystem health

and watershed comparison using conditional entropy profiles,” Index-2001-Congress, Rome, Italy, October 2001.

136. Invited Plenary Lecture, “Classified raster map simulation, accuracy assessment, and change detection using hierarchical transition matrix models,” Index-2001-Congress, Rome, Italy, October 2001.

137. Invited Plenary Lecture, “Upper echelons in synoptic mappings of scaled environmental indicators,” Index-2001-Congress, Rome, Italy, October 2001.

138. Invited Speaker, ‘Detection and Delineation of Critical Areas for Assessment and Management at Landscape Scales using Cellular Synoptic Data,’ International Society for Ecosystem Health Conference on Linkages Between Biodiversity, Ecosystem Health, and Human Health, Washington, DC, June 2002.

139. Invited Speaker, ‘Detection and Delineation of Critical Areas for Assessment and Management at Landscape Scales using Cellular Synoptic Data,’ The International Environmetrics Society Meetings, Genoa, Italy, June 2002.

140. Invited Speaker, ‘Prioritization and Ranking of Watersheds Based on Watershed Indicators Without Having to Integrate Indicators for Multi-Criterion Decision Support,’ The International Environmetrics Society Meetings, Genoa, Italy, June 2002.

141. Invited Speaker, ‘Geographic and Network Surveillance for Arbitrarily Shaped Hotspots: Next Generation of Potential Outbreak Detection and Prioritization System.’ National Syndromic Surveillance Conference, New York City, September 2002.

142. Presented paper, ‘Multiscale Advanced Raster Map Analysis System Definition, Design, and Development.’ RESE Conference, Stockholm, Sweden, November 2002.

143. Invited Keynote Lecture, “Environmental Health and a New Generation of Statistical Methods”, MISTRA Conference on Remote Sensing for the Environment, Government of Sweden, Stockholm, November 2002.

144. Invited Joint Inaugural Lecture with C. R. Rao, International Conference on Environment and Health related Quality of Life: Statistical Perspectives, France 2002.

145. Invited paper, ‘Upper Level Set Scan Statistic for Detection Arbitrarily Shaped Hotspots,’ Joint Statistical Meetings, San Francisco, August 2003.*

146. Invited Poster Presentation, Keystone Homeland Security Summit, University Park, April 2003.

147. Invited presentation, ‘Biosurveillance Geoinformatics of Hotspot Detection and Prioritization for Biosecurity,’ Washington Statistical Society, Washington, DC, February 2004.

148. Invited paper, ‘Surveillance Geoinformatics of Hotspot Detection, Prioritization, and Early Warning,’ NISS Workshop on Statistics and Counterterrorism, New York University, November 2004.

149. Seminar, ‘Biosurveillance Geoinformatics of Hotspot Detection and Prioritization for Biosecurity,’ Dept. of Biostatistics and Epidemiology, Cleveland Clinic, October 2004

150. Seminar, ‘Surveillance Geoinformatics of Hotspot Detection, Prioritization, and Early Warning,’ Statistical Engineering Division, National Institute of Standards and Technology (NIST), Washington, DC., October 2004.

151. Lecture, “Surveillance GeoInformatics of Hotspot Detection, Prioritization, and Early Warning,’ Northern Maharashtra University, India, and University of Poona, India, December 2004

152. Seminar, ‘Surveillance Geoinformatics of Hotspot Detection, Prioritization, Intervention and Sustainable Management,’ SV University, Tirupati, India, December 2004

153. Invited Speaker: “Upper Level Set Scan System for Detecting Arbitrarily Shaped Hotspots for Digital Governance,” Digital Government Research Conference, Atlanta, GA, May 2005.

154. Invited Paper: “Spatially Constrained Clustering in Surveillance GeoInformatics of Hotspot Detection and Early Warning,” InterFace Meetings, St. Louis, MO, June 2005.

155. Inaugural Keynote Address: “Surveillance GeoInformatics and Multiscale Advanced Raster Map Analysis for Sustainable Management,” International Conference on Environmental Statistics and Remote Sensing, Tokyo, Japan, Nov. 2005.

156. Plenary Lecture: “Hotspot GeoInformatics,” International Conference on Statistics and Applications, Fukuoka, Japan, November 2005.

157. Plenary Lecture: “Disease GeoInformatics for Hotspot Detection and Prioritization,” International Conference on Health GeoInformatics, Bangkok, Thailand, November 2005.

158. Organizer, Chair, and Invited Speaker: Session on Biosurveillance GeoInformatics for Biosecurity, ENAR Spring Meeting, Austin, TX, March 2005

Organizer and Chair: Luncheon Round Table on Biostatistics and Biometrics for Biosurveillance and Biosecurity Applications.

159. Organizer and Chair: Invited Paper Session on Ranked Set Sampling – 50 years. International Statistical Institute, Sidney, Australia, April 2005.

160. Organizer, Chair, and Invited Speaker: Joint Statistical Meetings, Minneapolis, MN. Session on Statistical GeoInformatics for Human Environment Interface in the mid-Atlantic Region of the United States, August 2005.

161. Organizer, Chair, and Invited Speaker: Session on Multiscale Advanced Raster Map Analysis for Ecosystem Health Monitoring, Assessment, and Management in the 21st Century. International Ecological Congress, Montreal, Canada, August 2005.

162. Invited Participant and Speaker, Environmental Performance Index Expert Workshop, Yale University, New Haven, CT, October 2005.

163. Plenary Lecture: Hotspot GeoInformatics for Monitoring, Etiology, Early Warning, and Management for Digital Governance in the 21st Century. International Conference on Statistics in the Technological Age, Kuala Lumpur, Malaysia Dec. 2005.

One day workshop. Session on Environmental Statistics and Surveillance GeoInformatics.

164. Plenary Lecture: Statistical GeoInformatics of Hotspot Detection and Prioritization for Monitoring, Etiology, Early Warning, and Management for Digital Governance International Conference on Statistics and Informatics in Agricultural Research, New Delhi, India, December 27-30, 2006.

Half day workshop: Hotspot GeoInformatics and Digital Governance for Agriculture with Emphasis on Biodiversity, Ecosystem Health, Watershed Management, Informatics, Crop Disease, and Sensor Networks.

*also session chair

(5) INVITED COLLOQUIUM LECTURES

(Recent years)

1. Patuxent Wildlife Research Center, Laurel, Maryland, November 1979
2. Denver Wildlife Research Center, Denver, Colorado, November 1979.
3. University of California, Berkeley, November 1979.
4. University of Hawaii, Honolulu, December 1979.
5. Southwest Forest Experiment Station, Berkeley, California, December 1979.
6. University of Trieste, Trieste, Italy, January 1980.
7. University of Milan, Milan, Italy, January 1980.
8. University of Poona, Poona, India, January 1980.
9. University of Louvain-La-Neuve, Belgium, January 1980.
10. Old Dominion University, Norfolk, Virginia, March 1980.
11. Institute of Statistics and Mathematical Sciences, University of Milan, October 1980.
12. Department of Zoology, University of Paris, October 1980.
13. Department of Statistics Colloquium, Pennsylvania State University September 1981.
14. Biostatistics Department Colloquium, Harvard University, Boston, MA., September 1981.

15. Council for Scientific and Industrial Research, Pretoria, South Africa, November 1981.
16. University of Orange Free State, Bloemfontein, South Africa, November 1981.
17. University of Stellenbosch, Stellenbosch, South Africa, November 1981.
18. University of Cape Town, Cape Town, South Africa, November 1981.
19. Joint Statistics-Zoology Colloquium, University of Toronto, Toronto, December 1981.
20. Inter-University Statistical Colloquium, McMaster University, Hamilton, Canada, 1981.
21. Institute of Genetics, University of Milan, Milan, Italy, December 1981.
22. Statistics Colloquium, University of Poona, Poona, India, December 1981.
23. Statistics and Ecology Seminars, University of Bombay, Bombay, India, December 1981.
24. Mathematics and Statistics Research Department, Computer Sciences and the Environmental Sciences Division, Oak Ridge National Lab, Oak Ridge, TN, March 1983.
25. Local ASA Chapter, Syracuse, New York, April 1983.
26. Department of Ecology and Evolution, University of Arizona, Tucson, AZ, February 1983.
27. Department of Mathematics, Syracuse University, Syracuse, New York, April 1983.
28. Statistical Ecology Colloquium, University of Poona, Poona, India, September 1984.
29. Biostatistics Colloquium, Harvard University, Boston, MA, October 1985.
30. Indian Agricultural Statistics Research Institute, New Delhi, March 1986.
31. Center for Ecological Sciences, Bangalore, India, March 1986.
32. National Institute of Oceanography and Marine Fisheries, Goa, India, March 1986.
33. Institute of Ecosystem Studies, New York Botanical Garden, May 1986.
34. Department of Statistics, University of Trieste, Trieste, Italy, December 1986.
35. Department of Biostatistics, Harvard University. Seminars on Encountered Data and Weighted Distributions, 1986.
36. Department of Biostatistics, Harvard University. Seminar on Meta Analysis, 1987.
37. Department of Statistics, University of Padua, Padua, Italy, 1988.
38. Department of Statistics, University of Bari, Bari, Italy, 1988.
39. Institute of Ecology, University of Parma, Parma, Italy, 1988.
40. Department of Statistics, University of Poona, Pune, India, 1989.
41. School of Environmental Sciences, University of Poona, Pune, India, 1989.
42. School of Environmental Sciences, Jawaharlal Nehru University, New Delhi, India, 1989.
43. Department of Statistics, University of Connecticut, Storrs, Connecticut, 1989.
44. Department of Statistics, North Carolina State University, Raleigh, NC, 1990.
45. Summer Session Seminar Series, Penn State University, University Park, PA, 1991.
46. Spring Seminar Series, Penn State University, University Park, PA, 1992.
47. Science, Technology, and Society Seminar, Penn State, University Park, PA, 1993.
48. Department of Mathematics and Statistics, American University, 1994.
49. School of Environmental Sciences, University of Poona, Pune, India, 1994.
50. Department of Mathematics and Statistics, Bowling Green State University, 1995.
51. Department of Statistics, Probability, & Applied Statistics, Univ. of Rome, Rome, Italy, 1995.
52. Department of Biology, San Diego State University, San Diego, CA, 1995.
53. Department of Statistics, Oregon State University, Corvallis, OR, 1998.
54. ISPRA, Italy, 1998.
55. University Lecture, North Maharashtra University, Jalgaon, MS, India, 1999.
56. CDC National Center for Health Statistics, October 2001.
57. EPA National Center for Environmental Assessment, October 2001.
58. Department of Mathematics, University of Maryland, October 2001.
59. Department of Environmental and Occupation Health, George Washington University.
60. Department of Geography, Penn State University, October 2001.
61. Department of Geography, Michigan State University, December 2001.

62. School of Natural Resources and Environment, University of Michigan, December 2001.
63. State University of New York, School of Public Health, February 2002.
64. New York State Department of Health, Albany, NY February 2002.
65. University of Connecticut, School of Public Health, March 2002.
66. Seminars on MARMAP System at NASA, EPA, NCHS, NIEHS, NCI, NSF, USDA, 2002.
67. Seminars on MARMAP System, departments of mathematics, statistics, and geography, Boston University, Spring 2003.
68. Harvard School of Public Health, 'Geoinformatic Surveillance for Hotspot Detection and Prioritization in Public Health and Ecosystem Health,' March 2003.
69. MIT Lincoln Laboratory, Geoinformatics seminar, March 2003.
70. Department of Statistics, George Mason University, 'Biosurveillance Geoinformatics of Hotspot Detection and Prioritization for Biosecurity,' April 2004.

(6) SCIENTIFIC AND HONOR SOCIETIES

1. Institute of Mathematical Statistics
2. American Statistical Association.
3. Biometric Society.
4. American Mathematical Society
5. Mathematical Association of America
6. Phi Kappa Phi Honor Society.
7. Sigma Xi Honor Society.
8. American Association of Advancement of Science.
9. Royal Statistical Society.
10. Ecological Society of America.
11. International Association of Ecology.
12. Society for Risk Analysis.
13. The Society of Population Ecology.
14. Natural Resource Modeling Association.
15. The Air and Waste Management Association.
16. The National Institute of Ecology, India.
17. The International Environmetrics Society
18. International Society for Ecosystem Health
19. American Society for Photogrammetry and Remote Sensing
20. Syndromic Surveillance Society
21. International EcoHealth Association
22. Digital Government Society

(7) HONORS IN PROFESSIONAL SOCIETIES

1. Elected Member, International Statistical Institute, 1967.
2. Fellow, American Statistical Association, 1967.
3. Fellow, American Association of Advancement of Science, 1968.
4. Fellow, Institute of Mathematical Statistics, 1972.
5. Founder Fellow, National Institute of Ecology, India, 1978.
6. First Distinguished Statistical Ecologist Award, International Association for Ecology, 1986.
7. Most Significant Paper Award, American Fisheries Society, 1987.
8. General Methodology Lecture, American Statistical Association, 1987.

9. Founding Chair, Committee on Fellows and Awards, Section of Statistics and the Environment, American Statistical Association, 1990-1992.
10. Chair, Distinguished Statistical Ecologist Award Committee, Statistical Ecology Section, International Association for Ecology, 1992- .
11. Founding Chair, Committee on Distinguished Achievement Medals, ASA Section on Statistics and the Environment, 1992-1994.
12. Founding Chair, Student Awards Selection Committee, ASA Section on Statistics and the Environment, 1992-1993.
13. Master of Ceremony, Distinguished Achievement Medal Awards at the Annual Meetings of the American Statistical Association with ASA Presidents Anderson and Hunter participating, 1993.
14. Master of Ceremony, Distinguished Statistical Ecologist Awards at the International Congress on Ecology in Manchester, UK with Sir Robert May, Sir Richard Southwood, and Presidents Knox, Golley, and Haber participating, 1994.
15. Inaugural Keynote Address to the Air and Waste Management Association International Specialty Conference, 1995.
16. Invited 50th Anniversary Volume Paper, International Biometric Society, 1996.
17. Vice Chair, Standing Committee on Environmental Statistics, International Statistical Institute, 1996 .
18. Plenary Lecture, First Indian Ecology Congress, India, 1996.
19. Master of Ceremony, Distinguished Statistical Ecologist Awards at the International Congress on Ecology in Florence, Italy with Presidents Knox, Golley, and Miyawaki participating, 1998.
20. Master of Ceremony, Ninth Lukacs Symposium Twentieth Century Distinguished Service Awards, 1999.
21. Best Paper Award, American Water Resources Association, 2002.

(8) POPULAR RECOGNITION

All India Radio, Bombay, 1959
 Canadian Television, Montreal, 1963
 All India Radio, Bombay, 1965
 Indian Newspapers on the Award of D.Sc., 1975
 Newspapers and Local Television in College Station, Berkeley, and Parma regarding the Satellite Program in Statistical Ecology, 1977-78; also in 1988
 Italian Television, Parma, Honorary D.Sc. Award Ceremony, 1988
 Italian Television, Trieste and Udine, International School on Statistical Distributions, 1980
 Newspapers in Montreal, Calgary, and Trieste regarding the Statistical Distributions in Scientific Work Program, 1963, 1974, 1980
 Indian Newspapers and State Television, Poona D. Litt Award Ceremony, 1989
 State Television, Bombay, India, School Dedication Ceremony, 1992
 Who's Who of various kinds
 One Thousand Great Scholars First Edition, Two Thousand Outstanding Intellectuals of the Twenty-First Century.

(9) WRITING AND EDITING

1. Author, Bibliography and Dictionary of Discrete Distributions. (With S. W. Joshi). Oliver & Boyd, Ltd., International Statistical Institute Series, 1968, pp. 268.

2. Author, A Modern Dictionary and Bibliography of Statistical
3. Distributions in Scientific Work Volumes 1, 2, 3. 1984.
4. Volume 1 - Discrete Models, pp. 1-458; Volume 2 - Continuous Univariate, Models, pp. 1-594; Volume 3 - Multivariate Models, pp. 1-431. (With M. T. Boswell, S. W. Joshi, M. V. Ratnaparkhi, and J. J. J. Roux).
5. Author, NSF-CBMS Monograph on Mathematical Stochastics of Species Abundance and Community Composition. (Under preparation).
6. Author, Monograph on Weighted Distributions and Their Applications, (With C. R. Rao and Marvin Zelen). (Under preparation).
7. Editor, Classical and Contagious Discrete Distributions. Proceedings of the 1963 International Symposium held at McGill University. Statistical Publishing Society, Calcutta and Pergamon, 1965, pp. 552.
8. Editor, Random Counts in Scientific Work. Expanded
9. from the Biometric Society Symposium held in Dallas, Texas at
10. the AAAS. Volume 1 - Random Counts in Models and Structures; Volume 2 - Random Counts in Biomedical and Social Sciences; Volume 3 - Random Counts in Physical Science, Geosciences, and Business. The Pennsylvania State University Press, 1970, pp. 767.
11. Editor (with E. C. Pielou and W. E. Waters), Statistical
12. Ecology. Proceedings of the International Symposium on
13. Statistical Ecology held at Yale University. Volume 1 - Spatial Patterns and Statistical Distributions; Volume 2 - Sampling and Modeling Biological Populations and Population Dynamics; Volume 3 - Many Species Populations, Ecosystems, and Systems Analysis. The Pennsylvania State University Press, 1971, pp. 1464.
14. Editor (with S. Kotz and J. K. Ord), Statistical
15. Distributions in Scientific Work. Expanded from the
16. Proceedings of the NATO Advanced Study Institute held at Calgary. Volume 1 - Models and Structures; Volume 2 - Model Building and Model Selection; Volume 3 - Characterizations and Applications. The D. Reidel Publishing Company, Dordrecht, Holland and Boston, Massachusetts, 1975, pp. 1200.
17. Editor (with J. K. Ord and C. Taillie), Statistical Distributions in Ecological Work. International Co-operative Publishing House, Fairland, Md., 1979, pp. 1-500.
18. Editor (with R. Cormack and D. S. Robson), Sampling Biological Populations, ICPH, Fairland, Md., 1979, pp. 1-400.
19. Editor (with F. Grassle, W. Smith, and C. Taillie), Ecological Diversity in Theory and Practice, ICPH, Fairland, Md., 1979, pp. 1-400.
20. Editor (with J. Cairns, and W. E. Waters), Environmental Biomonitoring, Assessment, and Management, ICPH, Fairland, Md., 1979, pp. 1-400.

21. Editor (with M. Rosenzweig), Contemporary Quantitative Ecology and Related Ecometrics, ICPH, Fairland, Md., 1979, pp. 1-725.
22. Editor (with C. Taillie and B. Baldessari), Statistical
23. Distributions in Scientific Work. Based on the International
24. Summer School on Statistical Distributions, Trieste, Italy. Volume 4 - Models, Structures, and Characterizations; Volume 5 - Inferential Problems and Properties; Volume 6 - Applications to Physical, Social, and Life Sciences. The Reidel Publishing Company, Dordrecht and Boston, 1981, pp. 1200.
25. Guest Editor (with G. Cantor, E. Landau, and C. Russell), American Statistician, November Special Issue for Statistics, Law, and the Environment, 1985.
26. General Editor of the Penn State Statistics Series. An International Series in Statistics and Applications, The Pennsylvania State University Press, 1970-1990.
27. General Editor, Statistical Distributions in Scientific Work Series, International Co-operative Publishing House, Fairland, Md., 1980- .
28. General Editor, Statistical Ecology Series, International Co-operative Publishing House, Fairland, Md., 1980- .
29. Editorial Board, Coenoses, the interdisciplinary journal reporting progress in community and population studies, Italy.
30. Editorial Board, International Journal of Ecology and Environmental Sciences, National Institute of Ecology, India.
31. Chairman, Publications Committee/Initiative, ASA Section on Statistics and the Environment, 1990-1994.
32. Editor (with Herbert Lacayo, Royal Nadeau and Larry Zaragoza), Proceedings of the Workshop on Superfund Hazardous Waste: Statistical Issues in Characterizing a Site: Protocols, Tools, and Research Needs. EPA Statistical Policy Branch, Washington, DC, 1991, pp. 254.
33. Editor (with Richard Gilbert and Walter Piegorsch), First Proceedings ASA Section on Statistics and the Environment, 1992.
34. Editor (with C. R. Rao), Handbook of Statistics, Volume 12: Environmental Statistics. North Holland and Elsevier Science Publishers, New York, 1994.
35. Editor (with C. R. Rao), Multivariate Environmental Statistics, North Holland and Elsevier Science Publishers, New York, 1993.
36. Editor, Monograph Series in Environmental and Ecological Statistics, Kluwer, Massachusetts and The Netherlands, 1999•.
37. Editor-in-Chief, Environmental and Ecological Statistics, Kluwer, Massachusetts and The Netherlands, 1994- .

38. Member, Editorial Advisory Board, *Environmetrics*, The Journal of the International Environmetric Society, 1992- .
39. Author, Monograph on Design and Analysis with Composite Samples: A Novel Method to Accomplish Observational Economy in Environmental Studies. (With S. D. Gore and C. Taillie). Chapman and Hall, New York and London, 199X. (Under preparation).
40. Author, Monograph on Ranked Set Sampling: A Novel Method to Accomplish Observational Economy in Environmental Studies. (With A. K. Sinha and C. Taillie). Chapman and Hall, New York and London, 199X. (Under preparation).
41. Editor, special issue of *COENOSSES* on statistical ecology in conjunction with 25 years of Penn State statistical ecology and environmental statistics. Issues 2/3, 1995.
42. Member, Editorial Advisory Board, *Ecosystem Health*, International Society for Ecosystem Health, 1995-.
43. Author, Monograph on Ecological Assessment with GLIM and Quasi-Likelihood (with Dario Gregori, Amarjot Kaur, and Charles Taillie). Chapman & Hall, New York and London, 199X. (Under preparation).
44. Editor, special issue of *Ecosystem Health* on Environmental and Ecological Assessment of Landscapes and Watersheds with Remote Sensing Data, 1999.
45. Author, Monograph on Modeling Analysis and Simulation of Multicategorical Raster Maps (With C. Taillie). Kluwer Academic Publishers, Dordrecht, The Netherlands. (Under preparation).
46. Author, Monograph on Understanding Surfaces: Echelon Analysis of Spatial Structure for Quantitative Geospatial Data. (With W. L. Myers). Kluwer Academic Publishers, Dordrecht, The Netherlands. (Under preparation).
47. Member, Editorial Board, *Ecohealth*, 2004—2008.
48. Author, Monograph on Landscape pattern analysis for assessing ecosystem condition (With G.D. Johnson). *Ecological Statistics Series*, Volume 1, Springer 130 pp, (2006).
49. Author, Monograph on Pattern-based compression of multi-band image data for landscape analysis (with W.L. Myers) *Environmental and Ecological Statistics Series*, Volume 2, Springer, 186 pp. (2006)

(10) STUDENT TRAINING AND EDUCATION

10.1 Graduate Programs and Course Developments

Graduate Program in Statistics: Founding Chair 1966.

Graduate Program in Statistics with Environmental Statistics Option: Prime Mover and Founding Member 1984-.

Graduate Program in Ecology with Quantitative Ecology Option: Prime Mover and Founding Member.

1984-

Graduate Courses involving Statistical Ecology, Environmental statistics, and Statistical Distributions in Scientific Work, such as: Stat 508, 524, 527, 528, 548.

Undergraduate courses involving Statistical Thinking, Biostatistics, and Basic Probability and Statistics, such as: Stat 100, 250, 409-410, 418, 427-428 (under discussion).

Bilateral formal and informal international research and training programs with Poona, India; Rome and Siena, Italy; and Guanajuato, National Center, Mexico.

10.2 Training and Education Highlights

Penn State Statistical Ecology and Environmental Statistics, Silver Jubilee Issue of *Coenoses*, 1995.

In the words of its editor-in-chief, Laszlo Orloci, himself an internationally distinguished statistical ecologist, a member of the Hungarian Academy of Sciences, and a Fellow of the Royal Society of Canada:

- ...The year 1994 marked the 25th year of statistical ecology with reference to the First International Symposium on Statistical Ecology held at Yale in 1969 with G. P. Patil, E. C. Pielou, and W. E. Waters as three co-chairs representing the fields of statistics, theoretical ecology, and applied ecology. ...

It was a wonderful feeling at the 1994 Manchester International Ecological Congress to witness a successful and impressive celebration of the Silver Jubilee of Statistical Ecology with Professor G. P. Patil as its chair and the master of ceremonies. ...

It is a great pleasure and honor for *Coenoses* to have Professor G. P. Patil, the founder and the father figure of statistical ecology, do this special statistical ecology issue in conjunction with the silver jubilee of statistical ecology. Interestingly, this is also the year when his home based programs in statistical ecology and environmental statistics at Penn State complete their 25 years. The papers for this issue have been reviewed and revised with a view to introduce our readership to the research, training, and outreach program at the unique and well-known Penn State Center for Statistical Ecology and Environmental Statistics of which Professor Patil has been the founder director, principal investigator, and distinguished professor. •

Department of Statistics, Inter-College Graduate Program in Ecology, Statistics 524--Ecometrics, 1995

Some twenty-five years ago, Professor Patil conceptualized and introduced a contemporary graduate course in Ecometrics. It is a required course for Quantitative Ecology option in the Inter-College Graduate Program in Ecology and for environmental statistics option in statistics.

For purposes of the special statistical ecology issue of *Coenoses* to celebrate the silver jubilee of Penn State Statistical Ecology and Environmental Statistics, five graduate students enrolled in Statistics 524 have prepared an invited paper on cross-disciplinarity of a statistical ecology and environmental statistics classroom at Penn State--a very refreshing and encouraging article indeed, reflecting on the innovative classroom approach of the instructor for productive crossdisciplinary content and the skill. The graduate student authors are: (1) M. Ghosh-Dastidar, Statistics; (2) G. D. Johnson, Quantitative

Ecology; (3) R. Norris, Biostatistics; (4) J. Orsin, Environmental Statistics, and (5) S. Shirk, Biostatistics.

Department of Statistics, International Research and Training, Collaboration Initiatives and Leadership, 1995

The Italian National Research Council has now begun to send its promising and young environmental statistics students to Penn State as visiting scholars and graduate interns:

(1) Loredana Di Consiglio, Rome; (2) Dario Gregori, Florence; (3) Matteo Grigoletto, Padova.; (4) Alessandra Capobianci, Rome; (5) Danila Filippini, Chieti; (6) Carla Sciullo, Rome.

The Penn State-Poona U.S.-India collaboration in environmental statistics has successfully continued over the past ten years under a Penn State-Poona MOU signed by Penn State President Bryce Jordan and Vice-Chancellor of Poona, M. G. Bhide, member of the Indian National Science Academy. The research collaboration has been largely on the statistical design and analysis with composite samples with Professor S. D. Gore as a visiting research associate. There have been also reciprocal visits by interested faculty both in Poona and Penn State.

The First Advanced Study Institute on Statistical Ecology in the United States, 1972.

University Park. Six weeks Duration. Post-Doctoral students Training.

Twenty select participants chosen with potential for impact within the subsequent five year period. Most everyone has been a great professional success. For example:

1. Roy Anderson, Zoology. Imperial College, London. FRS.
2. Bradford Brown, NMFS, Director, Southeast Fisheries Center.
3. Vincent Gallucci, Univ. of Washington. Leader in International Programs.
4. Michael Goodchild, UC Santa Barbara. Director, National NSF Center for Geographic Information Systems.
5. James Matis, Texas A&M. Chair, ASA SSE Committee on Distinguished Achievement Medals for Statistics and the Environment.
6. Michael Sissenwine, NMFS, Chief Scientist, Washington DC.

Satellite Program in Statistical Ecology, 1977-78

Berkeley, College Station, Parma, and Jerusalem, with headquarters at Penn State. Twelve weeks duration all together.

An extremely successful cross-disciplinary program involving three hundred and fifty distinguished interdisciplinary scientists and statisticians, each one playing the dual role of a professor and a student. Most everyone has been a great success.

Every other program has enjoyed similar outstanding success. These research and training programs have been organized either at Penn State or from Penn State. Most every participant has very fond memories of productive cross-disciplinary experience and growth. For more details, see the relevant entries and the related publications in the cv and its attachments giving both scientific and participant information. The next item is to serve as a typical prototype for the rest.

Multivariate Environmental Statistics Conference, 1992

University Park. One week Duration.

Multivariate environmental statistics is on the cutting edge of statistical theory and practice in environmental research, policy, and management. In response to the imminent need for a fruitful and productive forum for multivariate issues and methods in environmental statistics, a special multivariate environmental statistics component was set up as an integral part of the Seventh International Conference on Multivariate Analysis held at Penn State during May 92. Twenty-five distinguished invited speakers participated. The papers presented by these outstanding research workers discuss the

current state of the art in different areas of multivariate environmental statistics and provide new problems for future research and instruction. The timely volume edited by Patil and Rao has just appeared.

The audience consisted of both faculty, scientists, and advanced research students. The distinguished list of scholars participating included:

1. N. A. Cressie, well known spatial statistics specialist.
2. I. B. MacNeill, Editor, *Environmetrics*.
3. K. V. Mardia, well known author and researcher in *Multivariate Statistics*.
4. B. F. J. Manly, well known author and researcher in ecological statistics.
5. V. Barnett, Editor, *Wiley Series in Statistics in Practice*
6. J. V. Zidek, Editor, *Statistical Science*.
7. A. H. El-Shaarawi, President, *International Environmetric Society*.

Remaining Research, Training, and Outreach Institutes, Workshops, and Conferences

Most every program has been in a spirit similar to the above, and several distinguished and eminent individuals in various disciplines involving statistics, ecology, and the environment have been a part of these programs in one capacity or the other. Every program listed here has been held at Penn State or directed from Penn State. For more information, see the relevant literature listed elsewhere in the cv.

Statistical Distributions in Scientific Work Related:

- (1) Advanced Study Institutes on Statistical Distributions in Scientific Work with Headquarters at Penn State: Calgary, Canada, 1974; Trieste, Italy, 1980.
- (2) Advanced Workshop on Encountered Data, Weighted Distributions, and Meta-analysis University Park, PA, 1986

Statistical Ecology and Environmental Statistics Related:

- (1) Workshop on Statistical Issues and Approaches for Hazardous Waste Sites Characterization and Evaluation: Arlington, VA, February 1990; University Park, PA, June 1992
- (2) Short Course on Environmental Sampling, Observational Economy, and Statistical Decision Making: Hermosillo, Mexico, May 1993; Padova, Italy, August 1993
- (3) Workshop on Quantitative Analysis of Geospatial Data: Multiscale Ecological Assessment and Sampling Design: Florence, Italy, July 1998

10.3 Teaching Evaluation Scores

A Sampling of Student Evaluation Reports

*His close association with the material makes everything much more interesting than a textbook approach

*He is unique in his instruction. His effectiveness I would rate as excellent. For a change, I had an instructor who was available in the office whenever necessary

*Knowledge of material superb

*He connected many ideas and gave useful meaning to material. I got new insights and applications. Presentations could not have been clearer

*Very clear and beautifully organized

*He is very impressive in his knowledge of the subject and was able to convey this knowledge in a comprehensible manner. Highly effective. Class was very enjoyable and effective

*His presentations were very clearly well paced. His teaching methods are very effective. His philosophical approach gives one an excellent •feel• for the subject

*Personally, I think he is one of the finest instructors I have had at the university. Also for both personal advice and availability outside the classroom

*Clearest in the Stat Department in my experience

Course	Semester	Enrollment	# SRTEs	Question 3 Mean Response*	Question 4 Mean Response*
548	FA90	8	7	5.43	6.57
508	FA92	7	6	5.67	6.00
527	FA93	13	12	5.50	6.09
524	SP94	8	7	6.14	6.43
524	SP95	7	7	5.29	5.86
497A	FA96	7	7	5.57	6.71

SRTE: Student Rating of Teacher Effectiveness

SRTE's are not available prior to 1990. Classes with enrollment of less than 5 not included in above.

*Scale of 1 to 7: 7-Excellent; 1-Poor

Question 3: Rate the overall quality of this course

Question 4: Rate the overall quality of the instructor

10.4 Graduate Students in Statistics: (Thesis Advice and Supervision)

1. Shorrock, Richard (1962). McGill. M.S.

Stochastic and Sampling Processes for the Logarithmic Series Distribution.

2. Gordon, Florence (1963). McGill. M.S.

(Professor) Math Department, New York Institute of Technology, Old Westburg, NY

3. Sproule, Robert (1963). McGill. M.S.

4. Bildikar, Sheela (1966). McGill. Ph.D.

Certain Contributions to Multivariate Distributions Theory.

(Director) Biostatistics Division, Ciba-Geigy, Bombay, India

5. Wani, J. K. (1967). McGill. Ph.D.

Certain Studies on the Linear Exponential Family.

(Professor and Chair) Department of Statistics, University of Calgary, Calgary, Canada

6. Joshi, S. W. (1969). Penn State. Ph.D.

Certain Estimation and Structural Problems for a Class of Multivariate Discrete Distributions.

(Professor and Director) Department of Computer Science, Slippery Rock State University, Slippery Rock, PA

7. Vaughan, Douglas (1970). Penn State. M.A.

The Poisson Distribution.

(Team Leader) National Marine Fisheries Service, Beaufort Lab, Beaufort, NC

8. Janardan, K. G. (1970). Penn State. Ph.D.
On a Class of Multivariate Hypergeometric Models.
(Professor and Statistics Program Chair) Mathematics Department, Eastern Michigan University,
Ypsilanti, MI
9. Stiteler, W. M. (1970). Penn State. Ph.D.
Measurement of Spatial Patterns in Ecology.
(Director) Center for Risk Assessment, Syracuse Research Corp, Merrill Lane, Syracuse, NY
10. Friday, D. S. (1972). Penn State. M.A. (See #13)
11. Mahfoud, M. (1974). Penn State. M.A. (See #18)
12. Ratnaparkhi, M. V. (1975). Penn State. Ph.D.
Certain Damage Models and Related Characterizations of Statistical Distributions.
(Professor and Director) Department of Mathematics and Statistics, Wright State University, Dayton,
OH
13. Friday, D. S. (1976). Penn State. Ph.D.
A New Multivariate Life Distribution.
(Program Director) National Institute of Standards & Technology, Boulder, CO
14. Kapur, B. D. (1977). Penn State. M.S.
Structural Properties of Statistical Distributions Useful in Computer Generation of Random Variables.
(See #19)
15. Labovitz, Mark (1977). Penn State. M.A.
(Program Manager) NASA, Goddard Center, Washington, DC
16. Taillie, C. (1977). Penn State. Ph.D.
The Mathematical Statistics of Diversity and Abundance.
(Senior Research Associate) Center for Statistical Ecology and Environmental Statistics, Department of
Statistics, Penn State University, University Park, PA
17. Bitter, Linda (1978). Penn State. M.A.
18. Mahfoud, M. (1978). Penn State. Ph.D.
A Study of Weighted Distributions and Size-biased Sampling.
(Professor) Institut National de la Statistique et de l'Economie Appliquee, Rabat, Morocco
19. Kapur, B. D. (1978). Penn State. Ph.D.
Some Concepts of Stochastic Independence and Their Implications with Characterizations and
Simulations of the Related Models.
(Senior Statistician) Metropolitan Insurance company, Fishkill, New York
20. Catherine Gabel (1980). Penn State. M.A.
21. Barbara Bajusz (1980). Penn State. M.A.
(Research Associate) Colorado School of Mines, Golden, CO.

22. Brian Dennis (1980). Penn State. M.A.
Estimating Population Density with Point-to-Plant Distance Sampling in Heterogeneous Environments.
(Associate Professor) Forest Resources and Statistics, University of Idaho, Moscow, ID
23. Nancy Pitelli (1981). Penn State. M.A.
Sampling Techniques for Assessing Environmental Impacts.
24. Orsay Kuckemiroglu (1981). Penn State. M.A.
A Look into the Quantitative Way of Assessing Risk.
(Associate Professor) -Best Teaching Award- Department of Management Science, Penn State-York
25. Yousif Salih (1981). Penn State. M.A.
Logarithmic Normal Distribution and its Role in Scientific Research and Social Sciences.
26. Augustin Antwi (1981). Penn State. M.S.
Some Fundamental Concepts in Biological Sampling.
(Mortgage Consultant) Chatfield Dean & Co., Roslyn Heights, NY
27. Peninnah Smith (1983). Penn State. M.A.
Characterizing Insect Population Fluctuations Using Time Series Analysis with an Historical Respective.
28. Rafid Abdul-Razak (1983). Penn State. Ph.D.
Power Series Distributions in Mathematical Statistics and Applied Probability
(Assoc Professor) Department of Statistics, College of Science, Yarmouk University, Irbid, Jordan
29. Nicholas Bolgiano (1986). Penn State. M.A.
A Study of the Relationship Between Diversity Indices of Benthic Communities and Heavy Metal Concentrations of Northwest Atlantic Sediments.
(Statistical Research Assistant) Minitab, State College, PA.
30. Ernst Linder (1987). Penn State. Ph.D.
Statistical Inference in the Linear Errors-in-Variables Model Using the Bootstrap with Applications in Environmental Risk Analysis.
(Associate Professor) Mathematics Dept., University of New Hampshire, Durham, NH
31. Russell Lloyd (1988). Penn State. M.A.
Components of Community Structure and Their Use in the Development of Community Indices.
(Research Associate) Cornell Biological Research Station, Bridgeport, NY
32. Jeffrey Gove (1992). Penn State. M.A.
Plant Species Diversity on Even-Aged Harvests at the Hubbard Brook Experimental Forest: 10 Year Results
(Research Forester) N. E. Forest Experiment Station, Durham, NH
33. Cheryl Maki (1992). Penn State. M.S.
Composite Sampling in the Continuous Measurement Case.
(Statistical Research Assistant) Minitab, State College, PA.

34. Thomas Ruscitti (1993). Penn State. M.A.
Statistical Analysis of Left-Censored Environmental Data.
(Research Engineer) General Motors Corporation, Rochester, NY
35. Elvessa Aragon, current Ph.D. student
Design and Analysis with Composite Samples.
(Expected graduation 2000)
Statistics Research Division, Research Triangle Park, NC.
36. Glen Johnson (1995). Penn State. M.A.
Cost analysis of composite sampling for classification.
37. Sonia Rodriguez (1994). Penn State. M.S.
Ranked Set Sampling and Unequal Allocation. (See #46)
38. Dario Gregori (1995). Penn State. M.A.
Ecological applications of generalized linear models and quasi-likelihood methods: An overview
Department of Economics and Statistics, University of Trieste, Trieste, Italy.
39. Ruthanna Norris (1994). Penn State. M.A.
Estimation of multiple characteristics by ranked set sampling methods.
Division of Statistics and Biostatistics, FDA, Washington, DC
40. Susan Shirk (1994). Penn State. M.A.
Sampling with a concomitant variable: A comparison between ranked set sampling and stratified
random sampling.
Statistical Consulting Service, Hershey Medical Center, Hershey, PA.
41. Loredana Di Consiglio, current M.A. student
(Expected graduation August 2000)
Research Assistant, Institute of Statistics, Rome, Italy
42. Jo Orsin (1996). Penn State. M.A.
Ranked set sample sign test for quantiles under unequal allocation.
43. Rachel Williams (1996). Penn State. M.A.
The use of survival analysis for size regulation of Atlantic halibut.
Ph.D. Student at Clemson University, Clemson, SC.
44. Carla Sciuillo (1998). Penn State. M.A.
Research Assistant, Institute of Statistics, Rome, Italy
45. Senin Banga (2000). Penn State. Ph.D.
Risk analysis of benchmark dose for continuous response and sensitivity to model specification
Mathematical Statistician, Minitab, State College, PA.
46. Glen Johnson (1999). Penn State. Ph.D.
Landscape Pattern Analysis for Assessing Ecosystem Condition: Development of a Multi-Resolution

Method and Application to Watershed-Delineated Landscapes in Pennsylvania
Research scientist in the Geographic Research and Analysis Section of the Bureau of Environmental and Occupational Epidemiology with the New York State Department of Health.

47. Sonia Rodriguez (2001). Penn State. Ph.D.
Statistical Data Mining of Land-Cover Maps for Characterization, Classification and Comparison of Landscapes and Watersheds of Pennsylvania
Instructor, Department of Mathematics, University of Costa Rica

48. Danila Filipponi, (2000). Penn State. M.A.
Linear Spatial Analysis with a Monte Carlo Assessment of Predication Performance Using Estimated Variograms and with Both Gaussian and Skew Data.
ISTAT, Italy

49. Amy Burnicki (2001). Penn State. M.A.
Assessing the Similarity Between Neighboring Watersheds and Evaluating the Effects of Watershed Size on Conditional Entropy Profiles in the State of Pennsylvania.
University of Michigan.

50. Ryan D. Vraney (2002). Penn State. M.S.
Hotspot Detection and Regional Prioritization.
Data Mining Analyst for TrustSolutions, LLC. in Milwaukee, WI.

51. Yun Cai (2006) Penn State. M.S.

52. Yumei Wang (current)
Environmental and Occupational Health, Emory University, Atlanta, GA

53. Sham Bhat (current)

10.5 Graduate Students in Statistics: Internship Training

(Name, Dates of Internship Training, Present Position)

1. Erwin Atzinger (1968-70): Aberdeen Proving Ground.
2. Paul Mowery (1970-72): Johns Hopkins University.
3. Gregg Diffendal (1978-79): US Bureau of Census.
4. Anu Sharma (1980-82): Consulting Psychologist.
5. Suhasini Sabnis (1981-83): AT&T Bell Labs.
6. Robert Wood (1985-86): Finance and Investment, New York.
7. Sujata Rajarshi (1985-86): University of Poona.
8. Subhash Lele (1983-85): Johns Hopkins University, Biostatistics.
9. Kathryn Roeder (1983-85): Carnegie Mellon University, Statistics.
10. Eva Petkova (1988-90): Harvard University, Biostatistics.
11. Raul Macchiavelli (1990-91): Louisiana State University, Statistics.
12. Richard Waterman (1989-92): University of Pennsylvania, Statistics.
13. Matteo Grigoletto (1995): University of Padua, Padua, Italy.
14. Alessandra Capobianchi (1996): University of Rome, Italy
15. Carla Sciullo (1996-97): University of Rome, Italy

16. Danila Filipponi (1996-99): University of Chieti, Italy.
17. Martin Felix-Medina (1996-97): University of Sinaloa, Mexico.
18. Catarina Pisani (2000-2001): University of Florence, Italy.

10.6 Graduate Students Outside Statistics: Internship Training

(Name, Dates of Internship Training, Present Position)

1. Steven Stehman, Biology (1979-81): Syracuse University, Forestry.
2. Brian Horton, Biology (1979-81).
3. Judith Gordon, Ecology (1988-90): Alaska Fisheries.
4. Michael Murray, Agronomy (1989-90): Environmental Consulting.
5. Jeffrey Gove, Forestry (1989-90): Forest Service.
6. Russell Lloyd, Ecology (1986-88): Cornell University, Natural Resources.
7. Charles Orth, Plant Pathology (1992-93).
8. Helene Harvey, Forest Resources (1993-94): Forest Service.
9. John Mace, Health and Human Development (1980): Private Consultant, Washington, DC
10. Anna Ringvall, Swedish University of Agricultural Sciences, Umea, Sweden (1997-1998)
11. Mark Cochrane, Michigan State University (1997—1999).
12. David Walrath, Ecology (1998—2000).
13. Samboon Kiratiprayoon, Forest Resources, (2003—).
14. Angelo Pecci, University of Parma, Parma, Italy.

(11) COLLEGE AND UNIVERSITY SERVICE

Primarily responsible for the development of graduate and undergraduate courses, seminars, and miniseminars dealing with ecological statistics, environmental statistics, statistical distributions in scientific work and statistical thinking with an emphasis on to `uncover' and not just to `cover' and share the excitement with the class and the campus of mathematical statistics with an open mind unfolding the real life issues, methods, and approaches involving statistics, ecology, and the environment. An admirable cross-campus service to cross-disciplinarity and disciplinarity for statistical science.

Science strives for the discovery of significant Scientific Truth. It is Statistics that takes care of the uncertainty of the Scientific Method consisting of design, analysis, and interpretation, and even the assessment of significance. We find ourselves in the information age with year 2000 ahead of us. Statistics is a key scientific technology of the Information Age. The society in which we live has chosen to fully use Statistics as a decisive instrument to deal with societal crises, whether they be related to environment, education, economy, energy, engineering or excellence. While it is exciting that we are alive in the age of information, and while it is unfortunate that we find ourselves in the crisis of environment, it is only a bliss to have the opportunity to more effectively serve the cross-disciplinary cause of statistical ecology and environmental statistics in the research, training, and outreach setting.

11.1 Center for Statistical Ecology and Environmental Statistics, Department of Statistics Founder Director. 1984- .

The Center was initiated in the Department of Statistics under a Co-operative Agreement between NOAA/NMFS/Northeast Fisheries Center and Penn State. The Center is the first of its kind in the nation

and in the world, and enjoys national and international reputation. Research and training areas include statistical ecology, environmental statistics, and quantitative risk analysis. The Center has co-operative research grants with the National Science Foundation and the U.S. Environmental Protection Agency on Statistical Ecology, Environmental Statistics, and Environmental Monitoring and Assessment.

Broad research areas of the Center relate to mathematical statistics, statistical methodology, and data interpretation and improvement for future use. Current research projects and activities include spatial statistics, geographic information systems and remote sensing, multi-scale analysis, innovative sampling and observational economy, environmental monitoring and assessment, environmental data synthesis and statistical meta-analysis, spatial biodiversity evaluation, developmental toxicity and overdispersion analysis, benchmark dose assessment, risk assessment statistics, and others.

The Center has received \$3M research and outreach grants and cooperative agreements for environmental and ecological statistics during the twelve year period of the center under the auspices of EPA/ORD, EPA/OPPE, NOAA/NMFS, NOAA/NOS, NSF, and USFS. Continuously over the past three decades in the college at Penn State, Professor Patil's funding stands at a highest level in the country for a faculty member in statistics.

11.2 National Initiatives for Statistics, Ecology, and Environment

The Penn State national center initiative under the direction and leadership of Professor Patil brought together several outstanding colleagues and friends devoted to the cause of statistics, ecology, and the environment having magic to their name at the national and international level. It triggered enlightened push and support in every direction through its synergistic inputs and outputs initiated by the distinguished participants in their own home bases. The NSF, for example, initiated the Long Term Ecological Research (LTER) Program, the EPA initiated the Environmental Monitoring and Assessment Program (EMAP) and has moved to initiate a Bureau of Environmental Statistics (BES), and the USDI has announced the National Biological Survey (NBS). Several interested faculty members from within the College and the University participated.

11.3 Department of Statistics External Review, Departmental Strategic Planning Committee

Professor Patil served on the Strategic Planning Committee of the Department of Statistics in preparation for the external review of the Department. The External Review Committee included Bradley Efron, a member of the National Academy of Sciences, and Nicholas Winograd, Evan Pugh Professor of Chemistry. Everyone was enthused with an earlier news in the year that the Department has now moved into the top 20 in the country in the most recent NAS/NRC survey. The departmental initiatives in statistical ecology and environmental statistics under Professor Patil's leadership have helped enhance the standing and the visibility of the Department, both nationally and internationally.

11.4 Penn State Environmental Science and Technology Council and Environmental Risk Assessment Initiative: College Representative and Leadership Role

As the group leader of the risk assessment consortium initiative, Professor Patil made a presentation to the Council, and to the Provost and the Senior Vice-President for Research and Graduate Education. The Initiative was generally well received. It was under active consideration for university support as part of the initiative of the Council. Potential Advisory Board under consideration was: John C. Bailar, III, John Cairns, Jr., Rita Colwell, Bernard Goldstein, Robert Goodland, John Graham, Gene Likens, Frederick Mosteller, Jonathan Plaut, Paul Portney, C. R. Rao, Jerome Sacks, Rogbert Sokal, Sir Richard Southwood, and Ron Wyzga

11.5 Penn State Research on Wheels for the Commonwealth and Crystal Cube for Coastal and Estuarine Degradation: College Representative and Leadership Role

College representative and leadership role in the College initiative on 'Basic Science Basic for Progress' for the Graduate School Outreach for Penn State Research on Wheels for the Commonwealth of Pennsylvania, during 1987-1989. Professor Patil's Crystal Cube for Coastal and Estuarine Degradation was selected as an exhibit for the show on the road. The exhibits were on display at the Graduate School also.

11.6 Penn State General Education Conference and Incorporation of Uncertainty in General Education Initiative: College Representative and Leadership Role

College representative and leadership role in the college initiative for general education at the Penn State Conference on General Education called by the University President and the Provost in 1982. Professor Patil's initiative on the incorporation of uncertainty in general education was well received, leading to a joint paper with William Toombs, Director, Center for Higher Education, in the special issue of the Journal of General Education devoted to the conference theme. The title of the paper: General education in the face of uncertainty: The liberating effect.

11.7 Penn State India Advisory Task Force: College Representative and Leadership Role

College representative and chair of the Task Force, 1985-1995. Initiatives and interactions included Jawaharlal Nehru University, Centre for Policy Research, University of Poona, Northern Maharashtra University, Government of Maharashtra, and others. MOU's were initiated and developed at the University Presidents' levels. Distinguished scientists, educators, and leaders from India visited Penn State. And, so also, the faculty and administrators of Penn State visited India.

11.8 University and Department Committees

1. Founding Chair, Statistics Graduate Program, Department of Mathematics, 1966-1968.
2. Founding Chair, Statistics Colloquium, Department of Mathematics, 1966-1968.
3. Member, Policy Committee of the Department of Statistics.
4. Chair, First Tenure Committee for Biological Sciences, College of Science, 1972.
5. Statistical Colloquium Chairman, 1970-1972.
6. Founding Member, Interdisciplinary Graduate Program in Ecology, 1976- .
7. Member, Ecology Colloquium Program, 1976-1978.
8. Member, Genetics Program Review Committee of the Graduate School, 1976-1977.
9. Member, Program Review, Population Issues Research Office, 1977-1978.
10. Member, Tenure Committee for Biological Sciences, College of Science, 1978.
11. Member, Program Committee, Graduate Program in Ecology, 1980-
12. Founding Member, Quantitative Ecology Faculty, Graduate Program in Ecology, 1980- 13.
- Member, Biometrics Committee, Tenure Committee, Department of Statistics.
14. Member, Tenure Committee for Biological Sciences, College of Science, 1982.
15. Member and College of Science Liaison, PSU General Education Conference, 1982.
16. Chair, Promotion and Tenure Committee, Department of Statistics. 1985.
17. Member, Tenure Committee for Mathematical Sciences, College of Science. 1985.
17. Chair, India Advisory Task Force, PSU. 1985-1995.
18. Member, Awards Committee, Department of Statistics. 1990-1996.

19. Member, Graduate Studies Committee, Department of Statistics, 1990-1995.
20. Member, Tenure Committee for Mathematical Sciences, College of Science, 1990.
21. Chair, Faculty Search Committee, Department of Statistics, 1992-1993.
22. Member, Department Headship Search Committee, 1986-1990.
23. Member, Advisory Committee, Statistical Consulting Center, 1992-1993.
24. Chair, Advisory Committee, Graduate Program in Environmental Statistics. 1994- .
25. Member, Eberly College of Science Faculty Scholar Medal Committee, 1993.
26. Member, Faculty Advisory Committee, Dean, College of Science, 1993-1996.
27. Member, Environmental Science and Technology Council, 1993-1996.
28. Group Leader, Risk Assessment Consortium Initiative, Environmental Science and Technology Council, University Future Committee, 1995-1996.
29. Member, Faculty Search Committee, Department of Statistics, 1995-1996.
30. Member, Strategic Planning Committee, Department of Statistics, 1995-1996.
31. Member, Graduate Program Committee, Department of Statistics, 1996-1998.
32. Member, Advisory Strategic Planning Committee, Department of Statistics, 1996-1997.

11.9 Disciplinary and Interdisciplinary Faculty Interaction and Collaboration

M. G. Akritas (Statistics), censored data
 G. J. Babu (Statistics), Chesapeake Bay stock assessment
 M. T. Boswell (Statistics), statistical modeling and computing
 Colin Goodall (Statistics), spatial statistics
 Bruce Lindsay (Statistics), National Center initiative, likelihood studies
 J. K. Ord (Statistics), statistical distributions, time series
 C. R. Rao (Statistics), weighted distributions
 Steven Thompson (Statistics), adaptive sampling
 Robert Butler (Biology), aquatic ecology
 Charles Cooper (Biology), ecology
 C. Uhl (Biology), statistical landscape ecology
 F. M. Williams (Biology), statistical ecology
 K. Chatterji (Management Science), conflict resolution and decision making
 Shelby Fleischer (Entomology), precision agriculture and geostatistics
 Stewart Kurtz (Materials Science), statistics and materials science initiative
 A. MacEachren (Geography), scientific visualization
 S. Mann (Human Development), statistical modeling
 A. J. McDonnell (Environment), environmental resources research
 W. L. Myers (Forest Resources), ecological sampling
 S. Pennypacker (Plant Pathology), statistical ecology
 W. Tzilkowski (Wildlife), statistical ecology

11.10 Keynote Addresses in the National and International Events at the University

1. Visit of P. C. Mahalanobis to the University, 1966.
2. Penn State US-India Program on Agriculture in Maharashtra. Visit of Finance Minister, Bombay, India, 1969.
3. First Advanced Institute on Statistical Ecology in the United States. Chief Guest: Jerzy Neyman, 1972.
4. International Conference on Application of Computers and Operations Research in the Mineral Industry. Distinguished Guest: D. G. Krige 1986.

5. Conference on Weighted Distributions and Meta-Analysis. Distinguished Guests: Morris DeGroot, Ingram Olkin, C. R. Rao, and Marvin Zelen, 1986.
6. Institute of Mathematical Statistics Meeting. Silver Jubilee Banquet Speech. 1992.
7. Multivariate Environmental Statistics Conference. Distinguished Guests: T. W. Anderson, and John Tukey, 1992.
8. Inventory and Management Techniques in the Context of Catastrophic Events Conference. Distinguished Guests: Guy Lund and John Moser 1993.

11.11 Distinguished Statisticians Invited and Hosted

1. D. G. Chapman, Chair, International Whaling Commission.
2. P. C. Mahalanobis, F.R.S., Founder Director, Indian Statistical Institute.
3. C. R. Rao, F.R.S., Director, Indian Statistical Institute.
4. Morris DeGroot, Founding Editor, Statistical Science.
5. Marvin Zelen, Harvard Biostatistics.
6. P. V. Sukhatme, Director, FAO Statistics.

11.12 International Dignitaries Invited and Hosted

1. V. G. Bhide, Vice Chancellor, Poona, India.
2. M. D. Chaudhari, Finance Minister, Bombay, India
3. N. G. Goray, India High Commissioner to UK
4. S. C. Gupte, Vice Chancellor, Poona, India
5. V. A. PaiPanandiker, Director, Center for Policy Research, India
6. S. S. Varde, Education Minister, Bombay, India

11.13 Distinguished Statistical Ecologists Invited and Hosted

1. Paul Juhasz-Nagy, Member, Hungarian Academy
2. Robert May, Princeton and Oxford
3. Richard Hennemuth, Woods Hole
4. Orazio Rossi, Parma, Italy
5. Daniel Simberloff, Florida State
6. William E. Waters, Berkeley
7. Michael P. Hassell, FRS
8. John H. Lawton, FRS

11.14 Distinguished Visitors to the Department Invited and Hosted

1. C. Radhakrishna Rao, India
2. J. Roy, India
3. J. K. Ord, UK
4. J. E. Mosimann, NIH
5. J. H. Matis, Texas A&M
6. J. B. Douglas, Australia
7. Woollcott Smith, Woods Hole
8. Bruno Baldessari, Rome, Italy
9. Samuel Kotz, College Park, MD
10. David and Freda Kemp, UK

11. Kanti Mardia, UK
12. Philip Holgate, UK
13. Douglas Robson, Cornell
14. Charles Rohde, Johns Hopkins

11.15 Initiatives to Attract and Recruit to the College and the Campus

1. Frank Haight
2. Keith Ord
3. Jogesh Babu
4. C. R. Rao
5. Steven Thompson
6. Stephen Rathbun

11.16 Statistical Ecology and Environmental Statistics Visits Abroad

Shared Invitations and Visits with Colleagues in the College and on the Campus

1. India: Wayne Myers, Archie McDonnell
2. China: Marilyn Boswell
3. Mexico: Colin Goodall, Steven Thompson
4. Italy: Steven Thompson
5. Switzerland: Wayne Myers

(12) PROFESSIONAL SERVICE

12.1 Professional Review and Advice for Agencies and Organizations

1. EPA, ASA: National Acid Precipitation Assessment Program (NAPAP).
2. EPA: North American Free Trade Agreement, Improved Environmental Statistics and Reporting (NAFTA).
3. NSF, EPA: Initiative for National Center - A Center Without Walls.
4. NMFS, USFS, CBSAC, EPRI, GRI: Program Formulation, Risk Assessment.
5. Florida Fisheries Foundation: Shrimp By-Catch.

12.2 Initiatives and Advice for Professional Associations

1. ASA: Environmental Statistics Section
2. ESA: Statistical Ecology Section
3. INTECOL: Statistical Ecology Section
4. ISI: Committee on Environmental Statistics
5. INTECOL, ISI, and BS: Liaison Committee on Statistical Ecology
6. INTECOL: Silver Jubilee of Statistical Ecology Around the World
7. NIE: First Indian Ecology Congress

12.3 Outreach

1. Statistical Distributions in Scientific Work

2. Statistical Ecology
3. Environmental Statistics
4. Observational Economy
5. Site Characterization and Evaluation

12.4 Statistics as a Societal Instrument

1. Endangered Species Act
2. Ocean Dumping Act
3. National Fisheries Act
4. Forest Management Act
5. Superfund Act
6. NAFTA Act
7. Safe Drinking Water Act

12.5 Harvard Biostatistics Working Groups

1. Weighted Distributions
with Nan Laird, Marvin Zelen, and others
2. Meta-analysis
with Frederick Mosteller, James Ware, and others
3. Teratology
with Louise Ryan, D. F. Moore, and others

Part 3: Publications

Narrative Account of Quality and Importance of Published Research with a Sampling of Scholarly Contributions, Research Highlights, and Impacts

Quality and Importance

Professor Patil's research has been both fundamental and relevant. Both statistical ecology and environmental statistics have now become mainstream. His pioneering and outstanding contributions and research results are in constant demand, and are highly recognized and appreciated in both statistical and ecological and environmental circles. He has been a founder and father of statistical ecology and environmental statistics.

Professor Patil's contributions to statistical ecology cover a wide spectrum of research and publications. Statistical ecology is an evolving integrative area of research, and his personal research related to statistical ecology includes highly visible issues, such as: models of species abundance, measurement and analysis of spatial patterns, recruitment distributions in fisheries research, mathematical characterization of diversity profiles and community structure, size-biased sampling and modeling in observational studies, stochastic differential equation models of population abundance, and more recently, quantitative ecological risk analysis, for which he received a best paper award of the American Fisheries Society.

Surveys for monitoring changes and trends in our environment and its resources involve some unusual conceptual and methodological issues pertaining to the observer, the observed, and the observational process. The problems that are not typical of current statistical theory and practice arise. Professor Patil recognized this issue long time back and has pursued this important theme through his publications that relate to encounter sampling, encountered data, meta-analysis, and weighted distribution methods. It was only natural that the American Statistical Association invited him to speak on these hot issues in their prestigious methodology lectures series.

The societal problem of biodiversity is now well recognized. The national forest management act requires that management practices maintain the diversity of forest ecosystems. The measurement and comparison of diversity has been a longtime outstanding issue. Professor Patil chose to deal with this problem, and has several frontline publications to his credit. The reputed NSF/CBMS program invited him to its prestigious regional conference series to speak as a principal lecturer for a week to an extremely knowledgeable and distinguished audience. The report submitted by the NSF reviewer is simply glowing and impressive of Professor Patil's command on the content and its exposition.

Professor Patil's contributions to environmental statistics cover an equally wide spectrum of research and publications. Environmental statistics also is a frontline integrative area of research, and his personal research related to environmental statistics includes highly visible issues, such as: environmental monitoring and sampling, environmental assessment, observational economy, superfund site characterization and evaluation and improved environmental statistics and reporting. His research efforts and publications in this direction have been highly acclaimed. He was recently invited to be a U.S. delegate to the first NAFTA-related trilateral meeting on environmental statistics and reporting. He has been invited also to several short courses on environmental sampling, observational economy, and statistical decision making in both national and international settings.

Professor Patil's contributions to statistical distributions in scientific work also cover a wide spectrum of research and publications. He was invited at the Moscow International Mathematical Congress to chair a session and also speak on his work on discrete distributions and additive number theory. Essentially because of the present economic conditions in the present information age, the random quantities of interest lead increasingly to various kinds of distributional problems and requests for solution. Statistical distributions remain an important and focal area of study. The research efforts and

resultant publications of Professor Patil in this frontline subject area also have been prolific and pioneering. Lately he has been involved with the issue of small and skew data in conjunction with the evaluation of the hazardous waste site remediation and benchmark dose assessment.

And his latest research thrusts include statistical multiscale assessment of landscapes and watersheds with satellite and synoptic data. The NSF ranked his research grant proposal in a recent competition in the top 31 among 655 with the funding level at the 4th highest. This cross-disciplinary research has led to several pioneering and innovative breakthroughs and publications and to a productive involvement in the Map of Italian Nature Program in the Office of the Italian Prime Minister.

To provide initiative and leadership in such diverse fields requires unique personal qualities and high degree of innovative dedication, concern, and a sense of mission--characteristics that have been well demonstrated by Professor Patil through his publications and programs for three decades.

A Sampling of Scholarly Contributions and Impacts

1. Discrete Distributions and Additive Number Theory
2. Conditionally Specified Distributions
3. Sum-Symmetric Power Series Distributions
4. Weighted Distributions
5. Observational Economy
6. Composite Sampling and Hot Spot Identification
7. Ranked Set Sampling
8. Diversity Profiles
9. Preston's Canonical Hypothesis
10. Lorenz Orderings
11. Size-biased Permutations
12. Skew Distributions with Small Samples Initiative

1. Discrete Distributions and Additive Number Theory

A discrete random variable is one whose possible values form a subset T of the nonnegative integers. We have investigated problems of existence of minimum variance unbiased (MVU) estimators of parametric functions for the univariate and multivariate power series distributions in terms of the number theoretic structure of their supports T . The concepts of Schnirelmann density and of Kvara-Schnirelmann density from additive number theory play a decisive role in the existence theorems. A uniform technique of obtaining the MVU estimators, when they exist, has also been provided. Application has been made to several families of discrete distributions and to the mechanisms of observational damage and of truncation.

Important citations include: C. I. Bliss (President, Biometric Society); Joel Cohen (Author, Casual Groups of Monkeys and Men, Harvard University Press); H.A. David (Editor, Biometrics); A. S. C. Ehrenberg (Author, Repeat Buying, North Holland); Y. Linnik (Academician, USSR); J. Neyman (The Neyman); and R. Shimizu (Editor, Ann. Inst. Statist. Math.).

2. Conditionally Specified Distributions

Scientific problems often require the specification of joint distributions, and, here, it has long been recognized that the two marginal distributions do not determine the bivariate joint distribution. How, then, might the scientist identify a suitable bivariate model? We have suggested the two sets of conditional distributions as a useful basis for the choice. In this direction, we have proven that the two sets of conditionals uniquely determine the joint distribution (under some mild regularity conditions). We have also introduced the problem of conditional specification, i.e., if the two sets of conditional distributions belong to a particular parametric family, then what can be said about the parametric structure of the

joint distribution? Here, we have shown that the joint distribution belongs to the power series family when the two sets of conditional distributions are also of the power series class. With the availability of powerful computing facilities, the use of conditional specification has become feasible in recent years and the method has become the subject of intensive investigation. A recent book on the subject ("Conditionally Specified Distributions," by Arnold, Castillo, and Sarabia, 1992, Springer-Verlag, page 4-5) credits us with some of the "earliest work in this area."

3. Sum-Symmetric Power Series Distributions

The sum-symmetric power series distributions (SSPSD) constitute an important subclass of multivariate power series distributions that includes as special cases the multinomial, negative multinomial, multiple Poisson, multivariate logarithmic series, and their zero-truncated versions. We introduced the SSPSD class for the distributions occurring in direct and inverse sampling from populations with multiple characteristics. Research results have addressed the issues of structural relationships, characterization, and estimation.

Important citations include: O. E. Barndorff-Nielsen (Editor, Int. Statist. Rev.); J. K. Gosh (President, International Statistical Institute); J. E. Mosimann (NIH, Office of Scientific Integrity).

4. Weighted Distributions

Traditional statistical theory and practice have been occupied largely with observations involving randomization and replication. But, in ecological and environmental work, observations most often fall into the non-experimental, non-replicated, and non-randomized categories. The theory of weighted distributions provides a perceptive and unifying framework for some of these problems. Weighted distributions take into account the observer-observed interface, i.e., the method of ascertainment, by adjusting the probabilities of natural occurrence of events to arrive at a specification of the probabilities of those events as observed and recorded. The adjustment factor is referred to as the *weight function*.

Weight functions can be classified into three different levels of complexity:

- The weight function $w(x)$ depends only on the variable x under investigation. This situation has been referred to as encounter sampling.
- The weight function $w(x, _)$ also depends on parameters $_$ that do not appear in the natural distribution of x . This situation occurs in transect sampling and in meta-analysis.
- The weight function $w(x, _, _)$ depends on parameters $_$ that do appear in the natural distribution of x . This situation can occur with problems of over-dispersion and also in teratology.

Important citations include: C. R. Rao (FRS); N. P. Ross (Chief Statistician, EPA); Wolfgang Urfer (European Community); H. D. Vinod (Editor, J. Quant. Econ.).

5. Observational Economy

Sampling consists of selection, acquisition, and quantification of a part of the population. While selection and acquisition apply to physical sampling units of the population, quantification pertains only to the variable of interest, which is a particular characteristic of the sampling units.

Considerations of desirable criteria for representativeness and informativeness as variously defined usually lead to a desirable sample size of \bar{n} or more. On the other hand, considerations of resources in terms of cost, time, and effort usually lead to an affordable sample size of \underline{n} or less. A common experience is that $\underline{n} \gg \bar{n}$. This needs/resources dilemma has no universal panacea, but in appropriate circumstances, sampling protocols may be available that allow one to have both a large sample size and a small number of measurements, with all sampling units contributing to the information content of the measurements. We call this scenario "observational economy" (U.S. EPA 1995a,b). For observational

economy to be feasible, a minimum requirement is that identification and acquisition of sampling units be inexpensive as compared with their quantification. Interestingly, this need leads to innovative methods of sampling and environmental data acquisition, such as composite sampling, ranked set sampling, adaptive sampling, encounter sampling, etc.

Important citations include: C. R. Rao (FRS); EPA Series in Observational Economy; N. P. Ross (Chief Statistician, EPA).

6. *Composite Sampling and Hot Spot Identification*

Compositing can be efficient and cost effective when estimation of overall site parameters is the goal. However, compositing entails an enlargement of sample support and loses information at finer scales of spatial resolution. Recovery of this fine-scale information requires quantification of at least some of the pre-composite individual samples. Of particular interest is the identification of the fine-scale maxima (hot spots). Algorithms have been developed for achieving this identification while minimizing the number of sample quantifications. Current research, including graduate student theses work, seeks to identify and evaluate analogous algorithms for two-way compositing.

Invited paper is to appear in the Environmental and Ecological Statistics special issue on Composite Sampling, Guest Editors, Richard Gilbert (Battelle) and B. D. Nussbaum (EPA). A monograph on Design and Analysis with Composite Samples is in preparation for publication.

7. *Ranked Set Sampling*

A basic issue in sample survey design and subsequent inference is the effective utilization of auxiliary information, which may arise from such sources as (i) investigator judgement, (ii) past surveys, (iii) concomitant variables, (iv) remote sensing, (v) geographic information systems. Ranked set sampling exploits auxiliary information at the design stage by converting the information into rankings of small sets of sampling units. Research results on ranked set sampling have included: (a) performance comparisons with the regression estimator --- another method of incorporating auxiliary information in the form of concomitant variables, (b) finite population corrections for the variance of the RSS estimator, (c) effects of spatial clustering of the sampling units and identifying a relationship between performance of ranked set sampling and the variogram, (d) unequal allocation of sampling units to the different rank orders and development of implementable rules for achieving near-optimal allocations, (e) advantages and disadvantages of using the ranking information at the estimation (post sampling) stage, and (f) proof that the performance of ranked set sampling with imperfect ranking is an increasing function of the set size for a large class of ranking methods, called *coherent* rankings.

Invited paper is to appear in the Environmental and Ecological Statistics special issue on Ranked Set Sampling, Guest Editors, N. P. Ross (EPA) and Lynne Stokes (Texas). A monograph on Ranked Set Sampling is in preparation for publication.

8. *Diversity Profiles*

The meaning and importance of diversity as environmental and ecological parameters have been subjects of considerable debate. Our research has focussed upon classifying the basic concept of diversity. No single index can adequately characterize diversity because the responsiveness to rare and abundant species is index-specific. Instead an *intrinsic diversity ordering* has been developed that accounts for the full range of abundance and incorporates both the evenness and richness components of diversity. The α index of R.A. Fisher has been shown to fully characterize the intrinsic diversity for the log-series class of assemblages considered by Fisher. Several graphical displays, called *diversity profiles*, of the intrinsic diversity ordering have been developed along with their corresponding estimators. Empirical work has shown that diversity profiles for different communities often have at most one intersection point. An explanation has been given for this phenomenon by proving that a single

intersection is a characteristic of several parametric families of distributions that often approximately graduate species abundance. These include the gamma and lognormal families. Finally, the changes in genetic diversity during the approach to Hardy-Weinberg equilibrium have been studied. The changes do not have to follow a monotone trend with respect to the intrinsic ordering but are instead index-dependent. In particular, the Shannon index always increases during the approach to equilibrium.

Important citations include: Barry Arnold (Author, *Majorization and the Lorenz Order*, Springer-Verlag); John Cairns (Member, National Academy of Sciences); Jeff Gove (U.S. Forest Service); Robert May (FRS); C. R. Rao (FRS); L. R. Taylor (Editor, *J. Animal Ecol.*).

9. Preston's Canonical Hypothesis

This hypothesis was formulated by Preston (1962) as an approximate empirical relationship among the parameters of the lognormal model of species abundance, and has been extensively investigated by Robert May --- again in conjunction with the lognormal law. The hypothesis places limits on the form of the species-area curve and has implications for management practices at wildlife preserves. Our research has examined the hypothesis in the general setting of an arbitrary abundance model. Here, the approximate nature of the hypothesis places bounds on community diversity and also links the two components, evenness and species richness, of diversity so that when one of these increases the other tends to decrease. For the gamma abundance model, the canonical hypothesis specializes to R.A. Fisher's famous equation $H = S/k$ expressing diversity as the product of richness and evenness.

Important citations include: Brian Dennis (upcoming statistical ecologist); Michael Usher (well-known advisor on species-area relations); Orazio Rossi (First National Chair in Quantitative Ecology, Italy).

10. Lorenz Orderings

The Lorenz curve is an indicator of equitability in the distribution of incomes among individuals in the society. Our research has examined the responsiveness of the Lorenz curve to (i) different tax policies, (ii) truncation of available data to selected income levels, and (iii) random economic fluctuations. We have also characterized the Lorenz ordering for the generalized gamma family of distributions and have shown that the variance of the logarithm preserves the Lorenz ordering for this family of distributions. We have also proposed that an ecological analogue of the Lorenz curve be used to assess the species evenness component of ecological diversity. Here, it is shown that Fisher's evenness measure k characterizes the Lorenz ordering for the gamma abundance model, while the logarithm of the variance characterizes the Lorenz ordering for the lognormal model.

11. Size-Biased Permutations

R. A. Fisher and C. R. Rao have emphasized that the form of the distribution describing an observed quantity is dependent upon the method of ascertainment. The special case known as size-biasing occurs when the ascertainment probability is proportional to the variable itself. This notion of size-bias has been used to develop a class of stochastic ranking models in which larger items are more likely to receive a higher rank. The model has been applied to species abundance and diversity issues reflecting the fact that more abundant species are more likely to be observed when sampling (encountering) is by individual. The model has also been applied in the context of ranked set sampling to assess the impact of ranking error on performance. Here, ranking by size-biased permutation has been proven to satisfy the property of coherence.

Important citations include: Persi Diaconis (Harvard and Stanford mathematics).

12. Skew Distributions with Small Samples Initiative

Motivated by chemical contaminant data from Superfund hazardous waste sites, we have studied the two-sample hypothesis test involving scale alternatives for the gamma distribution. The data were

characterized by highly skew J-shaped distributions with generally small sample sizes, where normal theory methods fail. The investigation compared the likelihood ratio test, Rao's efficient score's test, and several nonparametric tests. For unequal sample sizes and two-sided alternatives the efficient scores test exhibited a severe bias, while the likelihood ratio test was nearly unbiased for all configurations examined. Performance of the nonparametric tests was very sensitive to the scoring method. Power for the Wilcoxon test was unacceptably low, while that of the Savage test approximated the power of the likelihood ratio test. A nonparametric test using the efficient scores for the chi-square with one degree of freedom was suggested as appropriate for this type of J-shaped data.

A Sampling of Research Highlights and Societal Impacts

1. Gypsy Moth Sampling Designs
2. Georges Bank Fisheries
3. Chesapeake Bay Stock Assessment
4. Crystal Cube for Coastal and Estuarine Degradation
5. Ocean Dumping, Sediment Quality, and Benthic Diversity
6. Deep Sea Red Crab Abundance Assessment
7. Forest Diversity and Management Practices
8. Composite Sampling for PCB Contamination
9. Multiscale Assessment of Landscapes and Watersheds
10. NAFTA and EMAP of USA

2. Georges Bank Fisheries

The purpose of this study was to investigate long-term recruitment for its potential use in long-term planning of fisheries development and management. As a first step, frequency distributions of recruitment were studied with parameters representing the total effects of all the factors including time. Several novel skew families of distributions were modeled and investigated, inclusive of some resulting from catastrophe theory. The specific purpose was two-fold: (i) to be able to identify the long-run frequency distributions of recruitment without regard to time, and (ii) to gain long-range insights that such a simplifying assumption should have to offer. The research effort developed approaches for making inferences about long-term yields with emphasis on the size and the frequency of good year classes.

3. Chesapeake Bay Stock Assessment

One of the initial tasks in the Chesapeake Bay Stock Assessment initiative was to review and analyze available time series data related to fishery stocks and potential causes of trends in their abundance with the objective of relating the trends to changes in fishing and habitat variables. Statistical problems that arose in connection with a conventional regression approach to the models included: (I) auto correlated errors, (ii) lagged dependent variables, (iii) correlations between the errors and the explanatory variables, (v) measurement errors, and (vi) nonlinearities, including interactions and threshold effects, in the form of the response function. One approach that fitted in well with the preceding biological models was that of categorical regression. The technique replaced all explanatory variables including lagged dependent variables, by discretized binary versions.

4. Crystal Cube for Coastal and Estuarine Degradation

Environmental and ecological risk assessment has become an important area of study in response to environmental policy, planning, and evaluation. Environmental decision makers like to have a crystal ball predicting ecosystem response to stress. Instead, a crystal cube was conceptualized, having a series of environmental indicator faces with each one in three colors representing no concern, warning, and alarm, based on a variety of field data on the coastlines of the United States. Ten environmental

indicators were identified for coastal and estuarine degradation. We chose the error of the first kind to be 1 in 10, partly because ecological variability is rather large, and also because a typical two-term ten-year manager may be able to stand a false alarm once in a ten-year period, which is also roughly half a human generation time. We chose error of the second kind to be 1 in 3 so that one is not caught napping in two successive years! A schematic crystal cube so constructed was on display in the state tour of Penn State Research on Wheels!

6. *Deep-Sea Red Crab Abundance Assessment*

Line transects are a survey method often used for assessing animal abundance. The Northeast Fisheries Center at Woods Hole had conducted an underwater photographic transect survey to determine the abundance of the deep sea red crab, *Geryon quinquedens* Smith, a commercially important species in continental slope waters off the northeastern United States. Upon analysis, the data were found to violate a major premise of transect methodology, namely, a falling off of sighting frequency with right angle distance. The cause was eventually identified and attributed to the optical geometry of the underwater camera system. A sighting function model was developed to account for both the optical bias and the traditional sighting distance bias. The research also led to a classification of factors affecting transect encounter probabilities into *object factors* and *survey factors*. Further, it was demonstrated that an inability to fully account for the object factors does not undermine the validity of transect abundance estimates or of their estimated standard errors.

7. *Forest Diversity and Management Practices*

The National Forest Management Act of the United States (NFMA) requires that management practices maintain the diversity of forest ecosystems. In collaboration with scientists from the USDA Forest Service, we have undertaken to evaluate the usefulness of intrinsic diversity and diversity profiles in assessing the compliance of different management practices with the NFMA mandate. We have presented analyses of intrinsic diversity trends following clearcut treatment for two completely different forest ecosystems: an 8-year study of plant community structure and succession in managed SE coastal plain pine plantations and a 7-year study in an old growth Douglas-fir forest in the western Cascades of Oregon. In the first system, data was analyzed for two watersheds chosen to bracket the management regimes most common in the region. In the other system, we used two different measures of relative plant abundance. In all cases, the intrinsic diversity of the post-treatment plant community was greater than that of the antecedent community within five years of treatment. Also of significance, is the similarity in the patterns of change across the different ecosystems.

8. *Composite Sampling for PCB Contamination*

The Pennsylvania Department of Environmental Resources (PADER) provided data giving the PCB concentration for some 12,000 surface soil samples. These samples had been collected from nineteen sites in Pennsylvania along the gas pipeline of the Texas Eastern Gas Pipeline Company. The PADER was interested in a retrospective evaluation of composite sample techniques for achieving more cost effective site characterizations. The problems addressed by the research include: (i) estimation of site parameters, (ii) number and location of individual soil samples to be composited, (iii) classification of individual soil samples as exceeding or not exceeding a specified critical level, and (iv) identification of samples with high PCB concentrations.

9. *Multiscale Assessment of Landscapes and Watersheds*

When a natural landscape is cast as a categorical raster map, a multiresolution characterization of spatial pattern can be obtained whereby the entropy is computed for a finer resolution map, conditioned on the values of a coarser resolution map. After application to a sequence of rescaled maps which have increasingly degraded resolution, the conditional entropy is plotted as a function of measurement scale

(resolution), thus resulting in a multiresolution profile of fragmentation patterns.

For neutral landscapes that are simulated by multiresolution stochastic generating models, we present a method to directly compute conditional entropy profiles. Such profiles can provide benchmarks for comparing results obtained from raster maps of actual landscapes that are classified from satellite images. Results show that characteristic landscape types give rise to characteristic features of these fragmentation (conditional entropy) profiles.

Contributions to Modern Statistical Distribution Theory, Statistical Ecology, Environmental Statistics, Spatial Statistics, Environmental Sampling, Biodiversity Measurement And Comparison, Risk Analysis, Statistical Landscape Ecology, Perspectives, And General Education

Subject Area

1. GENERALIZED POWER SERIES DISTRIBUTIONS

1.1 Patil, G. P. (1961). Asymptotic bias and variance of ratio estimates in generalized power series distributions and certain applications. *Sankhya Series A*, 23, 269-280.

1.2 Patil, G. P. (1962). Certain properties of the generalized power series distribution. *Annals of the Institute of Statistical Mathematics*, 179-182.

1.3 Patil, G. P. (1962). On homogeneity and combined estimation for the generalized power series distribution and certain applications. *Biometrics*, 18, 365-374.

1.4 Patil, G. P. (1962). Maximum likelihood estimation for generalized power series distributions and its application to a truncated binomial distribution. *Biometrika*, 49, 227-238.

1.5 Patil, G. P. (1962). Estimation by two moments method for generalized power series distribution and certain applications. *Sankhya Series B*, 24, 201-214.

1.6 Patil, G. P. (1963). Minimum variance unbiased estimation and certain problems of additive number theory. *Annals of Mathematical Statistics*, 34, 1050-1056.

1.7 Patil, G. P. (1964). Estimation for the generalized power series distribution with two parameters and its application to binomial distribution. Contributions to Statistics (70th Birthday Volume in Honor of Professor P. C. Mahalanobis), Pergamon Press and Statistical Publishing Society, Calcutta, 335-344.

1.8 Patil, G. P. (1965). On multivariate generalized power series distribution and its application to the multinomial and negative multinomial. In *Classical and Contagious Discrete Distributions*, Statistical Publishing Society, Calcutta and Pergamon Press, 183-194. Also in *Sankhya Series A*, 28, 225-237.

1.9 Patil, G. P. and Wani, J. K. (1966). Minimum variance unbiased estimation of the distribution function admitting a sufficient statistic. *Annals of the Institute of Statistical Mathematics*, 18, 39-47.

1.10 Patil, G. P. and Seshadri, V. (1975). A characteristic property of certain generalized power series distributions. In *Statistical Distributions in Scientific Work, Vol. I - Models and Structures*, G. P. Patil, S. Kotz, and J. K. Ord, eds. D. Reidel Publishing Company, Dordrecht, pp. 83-96.

.11 Patil, G. P. and Taillie, C. (1986). The fibonacci distribution revisited. *Communications in Statistics-Theory and Methods*, 15(3),951-959.

1.12 Patil, G. P. (1985). Multivariate power series distributions. In *Encyclopedia of Statistical Sciences*, Vol. 6, S. Kotz and N. L. Johnson, eds., John Wiley & Sons, New York. pp. 104-108.

1.13 Abdul-Razak, R. S and G. P. Patil (1986). Power series distributions and their conjugates in stochastic modeling and Bayesian inference. *Communications in Statistics-Theory and Methods*, 15(3), 623-641.

1.14 Patil, G. P. (1986). Power series distributions. In *Encyclopedia of Statistical Sciences*, Vol. 7, S. Kotz and N. L. Johnson, eds. John Wiley, New York. pp. 130-134.

1.15 Abdul-Razak, R. and Patil, G. P. (1994). Some stochastic characteristics of the power series distributions. *Pakistan Journal of Statistics*, 10(1), 189-203.

2. BINOMIAL AND NEGATIVE BINOMIAL DISTRIBUTIONS

2.1 Patil, G. P. (1960). On the evaluation of the negative binomial distribution with examples *Technometrics*, 2, 501-505.

2.2 Patil, G. P. (1963). On the equivalence of the binomial and inverse binomial acceptance sampling plans and an acknowledgement. *Technometrics*, 5, 119-121.

2.3 Patil, G. P. (1964). On certain compound Poisson and compound binomial distributions. *Sankhya Series A*, 26, 293-294.

2.4 Ozturk, O., Patil, G. P., and Taillie, C. (2000). Detection of contaminated observations in binomial sampling: A Bayesian approach. *Journal of Statistical Research*, 34, 42-60.

3. LOGARITHMIC SERIES DISTRIBUTIONS

3.1 Patil, G. P. (1962). Some methods of estimation for the logarithmic series distribution. *Biometrics*, 18, 68-75.

3.2 Patil, G. P. and Bildikar, S. (1966). On minimum variance unbiased estimation for the logarithmic series distribution. *Sankhya Series A*, 28, 239-250.

3.3 Patil, G. P. and Wani, J. K. (1965). Maximum likelihood estimation for the complete and truncated logarithmic series distributions. In *Classical and Contagious Discrete Distributions*, Statistical Publishing Society, Calcutta and Pergamon Press, pp. 398-409. Also in *Sankhya Series A*, 27, 281-291.

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- 30.17. Duczmal, Luiz, Patil, G.P., Taveres, Ricardo, Andre, Cançado. (2006). Detection of Spatial Clusters in Maps Equipped with Environmentally Defined Structures. (Invited Paper for Environmental and Ecological Statistics)
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- 30.32. Patil, G.P., Acharya, R., and Phoha, S. (2007) Digital Governance, Hotspot Detection, and Homeland Security, In: *Encyclopedia of Quantitative Risk Assessment*. John Wiley (Submission).

Part 3A: Chronological List of Research Publications

<u>Number</u>	<u>Year</u>	<u>Journal/Book</u>	<u>Title</u>	<u>Author</u>	<u>Order</u>
1	1960	Technometrics	2.1	GP	
2	1961	Sankhya	1.1	GP	
3	1962	Ann. Inst. Statist. Math. Tokyo	1.2	GP	
4	--	Biometrics	3.1	GP	
5	--	--	1.3	GP	
6	--	Biometrika	1.4	GP	
7	--	Sankhya	1.5	GP	
8	1963	Ann. Math. Statist.	1.6	GP	
9	--	Biometrika	6.1	GP	
10	--	Technometrics	2.2	GP	
11	1964	Ann. Inst. Statist. Math. Tokyo	7.3	RS	GP
12	--	J. Roy. Statist. Soc.	7.4	GP	VS
13	--	Mahalanobis Volume	1.7	GP	
14	--	Sankhya	2.3	GP	
15	1965	--	1.8	GP	
16	--	Class. and Contagious Discr. Dist.	1.8	GP	
17	--	--	3.3	GP	JW
18	--	--	28.1	GP	
19	--	--	25.1	GP	
20	--	--	27.1	GP	
21	--	--	27.2	GP	
22	--	Sankhya	7.1	GP	
23	--	--	3.3	GP	JW
24	--	--	3.4	GP	JW
25	--	J. Roy. Statist. Soc.	6.2	GP	RS
26	--	37th Int. Stat. Inst. Conf. Hndbk.	7.9	GP	
27	1966	Sankhya	3.2	GP	SB
28	--	Proc. Camb. Philos. Soc.	7.2	GP	SB
29	--	Ann. Inst. Statist. Math. Tokyo	1.9	GP	JW
30	1967	IEEE Trans. Informa. Theory IF-13	7.5	JB	GP
31	--	J. Amer. Statist. Assoc.	3.5	GP	SB
32	1968	Ann. Math. Statistics	6.3	SB	GP
33	--	Bull. Int. Statist. Inst.	7.6	KJ	GP
34	--	Sankhya	4.1	GP	
35	--	6th Int. Biometric Conf. Hndbk.	4.1	GP	
36	1970	Ann. Math. Statistics	4.2	GP	SJ
37	--	--	7.7	GP	MB
38	--	Statistical Ecology	9.1	WS	GP
39	--	Random Counts in Scientific Work	8.1	MB	GP
40	--	--	7.8	KJ	GP
41	--	--	5.2	KJ	GP
42	--	--	5.1	KJ	GP
43	--	--	28.4	GP	
	--	--	4.6	SJ	GP
44	1971	Sankhya	4.3	GP	SJ
45	--	Pompilj Volume	5.3	KJ	GP
46	--	Statistical Ecology	8.2	MB	GP
47	--	--	25.2	GP	
48	--	--	28.5	GP	EP WW
49	--	Intecol Bulletin	28.2	GP	
50	1972	Sankhya	5.4	KJ	GP
51	--	--	8.4	GP	MB
52	--	--	4.4	SJ	GP
53	--	Proc. Int. Conf. Stoch. Pt. Proc.	8.3	MB	GP
54	--	Bull. Int. Statist. Inst.	9.2	WS	GP
55	--	Proc. Soc. Eng. Science	9.3		
56	--	Intecol Bulletin	28.3	GP	
57	1973	Aust. J. Statist.	7.10	MB	GP
58	1974	Ann. Inst. Statist. Math.	5.5	KJ	GP
59	--	Theory Prob. App. Moscow	4.4	SJ	GP
60	--	Research on Population Ecol.	9.4	GP	WS

61	1975	Sankhya	7.11	KJ GP
62	--	Statist. Dist. Sci. Work	1.10	GP VS
63	--	--	6.4	
64	--	--	7.12	
65	--	--	7.13	AG GP
66	--	--	8.5	JO GP
67	--	--	8.6	GP MB
68	--	--	8.7	GP MB DF
69	--	--	28.6	GP SK JO
70	--	--	28.7	GP SK JO
71	--	--	28.8	GP SK JO
72	--	--	28.9	GP SK JO
73	--	--	25.3	GP
74	--	Int. Statist. Review	28.10	GP
75	1976	Computer Science and Statistics	11.2	DF GP MB
76	--	Proc. 9th Int. Biometric Conf.	13.1	GP CT
77	--	Sankhya	7.14	GP JO
78	--	Technical Report for EPA	13.6	
79	1977	Applications of Statistics	10.1	GP CR
80	--	Sankhya	10.3	GP MR
81	--	J. Multivariate Analysis	10.4	GP MR
82	--	Comm. Statistics	10.5	GP
83	--	Theory and Appl. of Reliability	11.1	DF GP
84	--	Bull. Int. Statist. Inst.	13.4	GP CT
85	--	Tropical Ecology	13.5	BD GP
86	1978	Biometrics	10.2	GP CR
87	--	Glimpses of Ecology	10.11	MM GP MR
88	1979	Statist. Dist. Ecol. Work	8.8	MB JO GP
89	--	--	28.13	JO GP CT
90	--	--	11.4	CT JO JM GP
91	--	Environ. Biomonitoring, Assess., Prediction and Management	10.9	GP CT RW
92	--	--	13.9	BD GP OR
93	--	--	28.16	JC GP WW
94	--	Ecol. Diversity Theory Practice	13.3	GP CT
95	--	--	13.8	BD GP
96	--	--	13.10	CT GP
97	--	--	28.15	JG GP WS CT
98	--	--	27.3	BD GP OR SS CT
99	--	Foreword to Stat. Ecol. Series	28.18	GP
100	--	Int. Statist. Review	28.12	GP
101	--	INTECOL Bulletin	28.13	GP
102	--	Contemporary Quantitative Ecol. and Related Ecometrics	28.17	GP MR
103	--	--	13.11	GP CT
104	--	--	27.4	BD GP MR SS
105	--	Sampling Biological Populations	28.14	RC GP DR
106	--	Canadian J. Statist.	10.6	GP MR
107	--	J. Indian Statist. Inst.	14.1	BK GP
108	--	Sankhya	10.7	GP CT
109	--	Int. Statist. Inst. Bull.	13.13	GP CT
110	1980	Advanced Concepts in Ocean Measurements for Marine Biology	10.10	GP CT RW
111	--	Statist. Dist. Sci. Work	28.20	CT GP BB
112	1981	Statist. Dist. Sci. Work (Vol.6)	13.7	JO GP CT
113	--	--	13.12	JO GP CT
114	--	Statist. Dist. Sci. Work (Vol.4)	10.13	CT GP
115	--	Ecologia	25.4	GP
116	--	S. African Statist. Assoc. Newsl.	25.4	GP
117	--	Stat. in Theory & Practice: Essays in Honor of Bertil Matern	10.14	MM GP
118	1982	J. General Education	15.3	GP WT
119	--	Statistics & Probability: Essays in Honor of C. R. Rao	10.12	MM GP
120	--	J. Amer. Statist. Assoc.	13.2	GP CT
121	1983	Encyclopedia of Statist. Sci.	28.19	GP
122	--	Proc. Conf. Renewable Res. Invent.		

123	--	Sankhya	13.14	JO GP CT
124	--	Proc. Conf. Renewable Resource Inventories for Monitoring Changes and Trends	25.7	RH GP
125	1984	Mathematical Biosciences	18.1	GP BD
126	--	STP 845, Stat. Environ. Sci.,ASTM	25.5	GP
127	--	--	25.6	GP
128	--	Sankhya	10.15	GP
129	1985	Encyclopedia of Statist. Sci.	1.12	GP
130	--	--	3.6	GP
131	--	--	6.5	GP
132	--	--	3.7	GP
133	--	Amer. Statist.	25.8	GP
134	--	--	26.1	EL GP JR
135	--	--	26.2	
136	--	ICES	10.18	RH GP CT
137	1986	Comm. Statist.-Theor. Meth.	10.16	GP CR MR
138	--	--	1.11	CT GP
139	--	--	1.13	RSA GP
140	--	Encyclopedia of Statist. Sci.	6.6	GP MR
141	--	N. Amer. J. Fish. Mgmt.	16.1	BB GP
142	--	Sea Technology	16.7	LP GP MB
143	--	Encyclopedia of Statist. Sci.	1.14	GP
144	--	INTECOL Newsletter	28.21	GP RH DS
145	--	Oceans 86 Special Issues	10.17	RH GP NR
146	--	--	10.19	GB MP GP
147	--	Encyclopedia of Statist. Sci.	13.16	BD GP
148	--	Oceans 86 Proceedings	16.4	MB EL JO GP CT
149	--	--	16.5	EL GP GS CT
150	--	--	16.6	MB GP
151	--	Proc. ASA/EPA Conference	16.8	GP CT
152	--	--	16.9	GP GB NB KC EL CT
153	--	Oceans 86 Special Issue	12.1	CB WM BP GP
154	--	Biometric Bulletin	28.22	GP
155	--	Ecological Modeling	16.3	EL GP DV
156	--	Maryland Sea Grant Conference Proceedings	16.10	MB GP JO
157	1987	Comm. Statist.	22.1	MB GP
158	--	COENOSSES	13.15	BS RL GP CT LC
159	--	Lognormal Distributions	18.2	BD GP
160	1988	Handbook of Statistics	12.2	GP GB RH WM MR CT
161	--	--	12.3	MB KB GP
162	--	--	12.4	FR CG GP CT
163	--	Encyclopedia of Statist. Sci.	4.5	GP MR
164	--	--	10.21	GP CR MZ
165	--	Statistical Sci.	10.23	NL GP CT
166	--	Proc. Int. Conf. Adv. Mult. Statist. Analysis	10.22	GP CR MR
167	--	Text of Speech (Italy Hon.Degree)	25.9	GP
168	1989	Text of Speech (India Hon.Degree)	25.10	GP
169	--	Statistical Data Analysis and Inference	10.24	GP CT
170	1990	Proc. Workshop on Superfund Hazardous Waste	9.5	NB GP CT
171	--	--	20.1	GP CT
172	--	--	22.2	MB GP
173	--	Special Report - Chesapeake Bay	17.1	JB EB NB MB JC BG GP NP LR
174	1991	Stock Assessment Committee NOAA Technical Report - Chesapeake Bay Stock Assessment Committee	17.2	NB EL JO GP MR CT
175	--	--	17.3	GB MB EL GP MR CT
176	--	--	17.4	MB JR SL WM GP MR CT
177	--	--	17.5	NB CB NB JF WM BP GP MR CT
178	--	--	17.6	NB MB GB GP CT
179	--	Environmetrics	10.25	GP
180	--	Bull. Int. Statist. Inst.	20.2	GP CT

181	--	J. Quantitative Economics	20.3	GP CT RW
182	--	Proc. ASA Section on Statistics		
183		and the Environment	20.4	GP CT
184	--	Proc. Symp. Systems Analysis in Forest Resources	13.17	JG DS SF GP
185	1992	Proc. 16h Int. Biom. Conf.	12.5	GP SG AS
186	--	Can. J. Forest Research	13.19	JG CM GP DS JH
187	1993	Multivariate Environmental Stat.	21.1	SG GP AS CT
188	--	--	16.11	EL GP GS
189	--	J. Applied Statist. Sci.	21.2	GP AS CT
190	--	Environmetrics	21.3	GP AS CT
191	--	Statistics for the Environment	10.27	GP CT ST
192	--	Handbook of Statistics, Vol. 9	11.5	MB SG GP CT
193	--	Bulletin of ISI	12.6	GP CT
194	--	Environmental Statistics Assessment, and Forecasting	12.7	GP SG AS
195	--	Abstracta Botanica	21.4	GJ GP AS
196	1994	Handbook of Statistics, Vol.12	22.3	GL SG GP
197	--	--	13.21	NB RR GP
198	--	--	21.6	GP AS CT
199	--	--	13.18	JG GP BS CT
200	--	--	25.12	GP
201	--	--	16.12	MB JO GP
202	--	--	20.6	MA TR GP
203	--	J. Statist. Research	16.13	ST GP CT
204	--	EES	22.4	SG GP
205	--	--	20.5	GP CT
206	--	Int. J. Ecol. & Environ. Sci.	21.5	GP AS CT
207	--	EES	25.11	GP
208	--	Parisankhya Samikkha	12.9	EA SDG GP
209	--	Proc. Specialty Conf.	20.7	GJ GP
210	--	Pakistan Journal of Statistics	1.15	RAR GP
211	--	1994 ASA Proceedings	23.1	WM GJ GP
212	--	1994 ASA Proceedings	25.13	GP
213	1995	Monte Verita Conference Proceed.	12.8	WM GP
214	--	Ecological Modelling	13.22	JG GP CT
215	--	EES	16.14	ST GP CT
216	--	EES	27.5	AK GP AS CT
217	--	EES	25.14	GP
218	--	EES	22.5	GP
219	--	EES	10.28	AK LD GP CT
220	--	Ann. Inst. Statist. Math.	21.7	GP AS CT
221	--	Chiang-Mai Proceedings	13.23	WM GP CT
222	--	Proc. A&WM Conf	20.8	GJ BN GP NR
223	--	COENOSSES	19.2	AK DG GP CT
224	--	COENOSSES	9.6	WM GJ GP
225	--	COENOSSES	9.7	GJ GP
226	--	COENOSSES	25.16	GP
227	--	COENOSSES	25.17	GP
228	--	COENOSSES	25.18	GP
229	--	COENOSSES	23.2	GJ GP
230	--	COENOSSES	21.8	RN GP AS
231	--	EES	21.9	GP
232	--	EES	18.3	CT GP RCH
233	1996	EES	27.6	MB SG GL GP
234	--	Proc. Conf. Extreme Values	22.6	EA SG GP
235	--	J. Applied Statistics	21.10	AK GP SS CT
236	--	Advances in Biometry	25.15	GP
237	--	Statistica Applicata	19.1	AK DG GP CT
238	--	Spatial Accuracy Symposium	23.3	GP GJ MG
239	--	INT.J. ECOL.ENVIRON.SCI.	23.4	GP MG GJ
240	--	EES	22.7	SG GP CT
241	--	Chance Magazine	21.11	GJ BN GP NR

242	--	Biodiversity in Managed Landscapes	13.20	JG GP CT
243	1997	EES	23.7	WM GP KJ
244	-	J. Statist. Plan. & Inference	21.14	GP AS CT
245	-	Biometrics	21.13	AK GP CT
246	-	Coenoses	19.3	DC AK GP WM CT
247	-	Bull. Nat. Inst. Of Ecology	25.20	GP GJ BN NR
248	-	J. Ecol. Environ. Sci.	25.21	GP GJ WM CT
249	1998	Biodiversity for Improved Forest.	23.5	GJ WM GP DW
250	-	Encyclopedia of Biostatistics	10.29	GP
251	-	Biodiversity for Improved Forest.	23.6	GJ GP SR
252	-	Forest Science	13.24	JG GP
253	-	Modern Trends in Ecol.	25.19	GP
254	-	Ecology Today	23.8	GP,GJ,WM
255	-	ASA Proceedings of SSE	24.7	DF GP CT
256	-	-	24.3	GJ WM GP CT
257	1999	EES	21.16	EA GP CT
258	-	EES	24.3	GP AS CT
259	-	Landscape Ecology	24.2	GJ WM GP
260	-	EES	27.7	GP AS CT
261	-	Ecological Modeling	24.4	WM GJ GP CT
262	-	Ecosystem Health	24.1	GJ GP
263	-	Trans. Mem. Roy. Soc. Canada	25.23	DR NC JK GP
264	-	Bull. Int. Statist. Inst.	24.10	GP CT
265	-	Mult. Anal., Design of Exp.& Surv. Sampl.	24.8	WM GP CT
266	-	Ecosystem Health	24.12	WM GP CT
267	-	Ecosystem Health	25.24	WM GP
268	2000	Statistics for the 21 st Century	24.11	GP,GJ,CT,WM
269	-	Math. And Comp. Modeling	24.9	GP WM ZL GJ CT
270	-	Forest Ecology and Management	12.12	AR GP CT
271	-	Community Ecology	23.9	KK WM GP
272	-	EES	16.15	SB GP CT
273	-	EES	25.25	GP
274	-	Intecol-Research Activities-	25.26	GP
275	-	J. Statist. Research	21.15	AK GP CT
276	-	J. Statist. Research	2.4	OO GP CT
277	-	Ann. Inst. Statist. Math.	21.12	AK GP CT
278	2001	EES	24.13	GJ WM GP CT
279	-	EES	24.14	GP CT
280	-	EES	22.11	GJ GP
281	-	J. of Statist. Research	25.22	GP
282	-	J. of Statist. Research	24.5	WM GP CT
283	-	J. Amer. Water Res. Assoc.	24.16	GJ WM GP
284	-	Risk Analysis	16.18	SB GP CT
285	-	Community Ecology	23.12	GP CT
286	-	Community Ecology	12.14	WM JB RB GP
287	-	Landscape Ecology	24.15	GJ WM GP CT
288	-	Cartografia Multiscalare	23.13	GJ WM GP TO RB
289	-	Amer. J. Math. & Mgmt. Sci.	21.19	AS VP GP CT
290	-	EES	22.8	GP CT
291	-	EES	22.9	SG GP CT
292	-	EES	10.31	SC GP CT
293	2002	J. Statist. Plan. & Inf.	21.17	AK GP CT JW
294	-	Community Ecology	12.13	GP CT RV
295	-	Sankhya	24.18	GP CT
296	-	Encyclopedia of Environmetrics	21.18	GP
297	-	Encyclopedia of Environmetrics	23.10	GP
298	-	Encyclopedia of Environmetrics	10.30	GP
299	-	Encyclopedia of Environmetrics	23.11	WM GP
300	-	Encyclopedia of Environmetrics	13.25	GP
301	-	Encyclopedia of Environmetrics	22.10	GP
302	-	Encyclopedia of Environmetrics	28.33	GP

303	-	Encyclopedia of Environmetrics	28.34	302
304	-	EES	16.16	SB GP CT
305	-	EES	16.17	SB GP CT
306	-	Ecosystem Health	24.20	GP RB WM DR CT
307	-	EES	24.21	GP JB WM CT RV DW
308	-	Novos Rumos Em Estatistica	24.23	GP
2003				
309	-	Managing for Healthy Ecosystems	24.19	GP RB WM CT
310	-	Managing for Healthy Ecosystems	25.27	GP
311	-	Sustainable Environments	24.24	GP
312	-	Community Ecology	24.25	WM GP CT DW
313	-	Community Ecology	24.26	WM GP CT
314	-	Statistical Science	24.28	GP CT
315	-	Encyclopedia of Life Support Syst	28.35	GP
2004				
316	-	J.Ind.Soc.Ag.Statist.	24.27	AB GP CT
317	-	EES	23.14	
318	-	EES	24.21	
319	-	EES	24.29	
320	-	EES	24.30	
321	-	EES	28.36	
322	-	EES	29.1	
		EES	30.3	LG GP CT
		Proc. National Conf. DG	30.4	GP CT
2005				
323	-		28.12	JO GP
324	--		10.8	GP CT
325	--		10.20	GP CR MZ
326	--		11.3	
327	--		14.2	
328	--	JABES	12.10	DP GP CT
329	-	J. Statist. Plan. & Inf.	24.3	GJ WM GP CT
330	-	Advances on Methodological..	12.11	GP CT
331	-	J. Statist. Plan. & Inf.	24.6	WM GP CT
332	-	EES	24.22	GP CT
333	-	EES	24.31	DW JB ME KH WM GP CT
334	-	Community Ecology	24.32	WM NK GP
335	-	EES	30.5	DW JB ME KH WM GP CT RB
336	-	Proc. National Conf. DG	30.6	GP SR RA PP RM
337	-	Proc. National Conf. DG	30.7	GP SR RA PP RM
338	-	Community Ecology	30.8	WM NK GP
2006				
339		IN Partial Order in Env. Science and Chemistry	30.9	WM GP YC
340		Acta Biotheoretica	30.10	WM GP
341		EES	30.11	GP RM WM PP
342		JSPI (SN Roy Cent. Volume)	30.12	RM GP
343		IN Digital Government	30.18	GP RA AG WM SP SR
344		DGO 2006	30.19	GP
345		DGO 2006	30.21	GP
346		DGO 2006	30.22	GP LD MH PP
347		DGO 2006	30.23	LD GP RT AC
348		DGO 2006	30.24	MH JM GP
349		IN Encyclopedia of GIS	30.26	GP RA WM SP RZ
350		ISPRS	30.27	WM GP
351		Workshop, Verbania	30.28	GP SB
352		Workshop, Verbania	30.29	WM GP
353		IN Ency. Digital Govern.	30.30	GP RA RM WM SR

2007 Under Preparation, Revision, or Submitted

354.	IN Ency. of Quan. Risk Assess.	30.31	GP SJ SR
355.	IN Ency. of Quan. Risk Assess.	30.32	GP RA SP

Part 3B: Citation Index for Paper Publications

•Up to 1993•

Frequency of Citations of Papers by Scientific Themes and Five year Periods

This tabulation shows the impact of and appreciation for the nominee's work in a diversity of thematic areas.

Broad triangular arrangement of the tabulated citation frequencies is largely indicative of the time periods in which the thematic work was initiated and/or accomplished.

The scientific themes and the corresponding serial numbers are: 1. Generalized Power Series Distributions; 2. Binomial and Negative Binomial; Distributions; 3. Logarithmic Series Distributions; 4. Sum-Symmetric Power Series Distributions; 5. Hypergeometric Distributions; 6. Exponential-Type Distributions; 7. Structural Relations and Characterizations; 8. Chance Mechanisms; 9. Spatial Statistics; 10. General; 11. Bibliographic Contributions; 12. Modeling and Analysis with Encountered Data; 13. Multivariate Distributions: Modeling and Simulation; 14. Survey Design and Sampling; 15. Diversity and Abundance; 16. Size and Shape Analysis; 17. General Education and Coping with Uncertainty; 18. Perspectives; 19. Risk Analysis; 20. Chesapeake Bay Stock Assessment; 21. Stochastic Models of Abundance; and 22. Peer Reviews

Theme	60-64	65-69	70-74	75-79	80-84	85-89	90-93	TOTALS
1	19	24	29	19	13	3	4	111
2		6	3	1		2		12
3	3	3	8	16	7			37
4			8	4	3		3	18
5			1	3			1	5
6		7	6	7	5	1		26
7		11	4	5	12	8	1	41
8			5	27	31	19	8	90
9				9	12	15	6	42
10				3	1	4	2	10
11						1		1
12				2	13	20	9	44
13					4	6	1	11
14							2	2
15				6	36	37	25	104
18			1			6		7
19						4	1	5
20							1	1
21						4	2	6
22						1		1
TOTALS	22	51	65	102	137	131	66	574

Citations for the Top Five to Ten Papers

Mathematical Statistics Area

1. (CV 1.6) Patil, G. P. (1963). Minimum variance unbiased estimation and certain problems of additive number theory. *Annals of Mathematical Statistics*, 34, 1050-1056. Number of Citations: **42**

2. (CV 7.4) Patil, G. P. and Sheshadri, V. (1964). Characterization theorems for some univariate probability distributions. *Journal of the Royal Statistical Society, Ser. B*, 27, 286-292.

Number of Citations: **21**

3. (CV 8.1) Boswell, M. T. and Patil, G. P. (1970). Chance mechanisms generating negative binomial distributions. In *Random Counts in Scientific Work*, Vol. 1, G. P. Patil, ed., Pennsylvania State University Press, pp. 3-22. Number of Citations: **47**

Statistical Distributions in Scientific Work Area

4. (CV 8.2) Boswell, M. T. and Patil, G. P. (1971). Chance mechanisms generating logarithmic series distribution used in the analysis of number of species and individuals. In *Statistical Ecology*, Vol. 1, G. P. Patil, E. C. Pielou and W. E. Waters, eds. Pennsylvania State University Press, pp. 99-130. Number of Citations: **20**

5. (CV 7.14) Patil, G. P. and Ord, J. K. (1976). On size-biased sampling and related form-invariant weighted distributions. *Sankhya*, 38, 48-61. Number of Citations: **16**

6. (CV 10.2) Patil, G. P. and Rao, C. R. (1978). Weighted distributions and size biased sampling with applications to wildlife populations and human families. *Biometrics*, 34, 179-189. Number of Citations: **46**

Statistical Ecology and Environmental Statistics Area

7. (CV 9.4) Patil, G. P. and Stiteler, W. (1974). Concepts of aggregation and their quantification: A critical review with some new results and applications. *Researches in Population Ecology*, 15, 238-254. Number of Citations: **51**

8. (CV 13.2) Patil, G. P. and Taillie, C. (1982). Diversity as a concept and its measurement. *Journal of the American Statistical Association*, 77, 548-567. Number of Citations: **74**

9. (CV 18.1) Dennis, B. and Patil, G. P. (1984). The gamma distribution and weighted multimodal gamma distributions as models of population abundance. *Mathematical Biosciences*, 68, 187-212. Number of Citations: **26**

10. (CV 24.2) Johnson, G. D., Myers, W. L., Patil, G. P. (1999). Stochastic generating models for simulating hierarchically structured multi-cover landscapes. *Landscape Ecology*, 14, 413-421.

Part 4: Funding Support for Research and Outreach on Statistical Ecology, Environmental Statistics, and Statistical Distributions in Scientific Work

Principal Investigator: G. P. Patil

I. STATISTICAL ECOLOGY AND ENVIRONMENTAL STATISTICS*

1969-70	Ford Foundation	\$25,000
	U. S. Forest Service	
1972-73	National Science Foundation	\$50,000
	U. S. Forest Service	
	Mathematical Social Sciences Board	
1977-79	NATO Scientific Affairs Division	\$200,000
	U. S. National Marine Fisheries Service	
	U. S. Environmental Protection Agency	
	U. S. Fish and Wildlife Service	
	U. S. Army Research Office	
	International Statistical Ecology Program	
1980-83	U. S. National Marine Fisheries Service	\$250,000
	International Statistical Ecology Program	
1984	U. S. National Marine Fisheries Service	\$150,000
	Ocean Assessments Division	

	U. S. Forest Service	
1985	U. S. National Marine Fisheries Service NOAA Chesapeake Bay Stock Assessment Program Oak Ridge National Lab/NOAA Ocean Assessments Division	\$350,000
1986	U.S. National Marine Fisheries Service NOAA Chesapeake Bay Stock Assessment Program Environmental Protection Agency	\$215,000
1987	U. S. National Marine Fisheries Service NOAA Chesapeake Bay Stock Assessment Program Environmental Protection Agency	\$150,000
1988-89	NOAA Chesapeake Bay Stock Assessment Program Environmental Protection Agency SRA Technologies/Environmental Protection Agency	\$300,000
1990	U.S. Environmental Protection Agency	\$225,000
1991	U.S. Environmental Protection Agency	\$275,000
1991	Pennsylvania Department of Environmental Resources	\$125,000
1992	U. S. Environmental Protection Agency	\$275,000
1993	U. S. Environmental Protection Agency	\$250,000
1994	U. S. Environmental Protection Agency	\$350,000
1995	U. S. Environmental Protection Agency	\$250,000
1995	National Science Foundation (1995-1998)	\$400,000
1996	U. S. Environmental Protection Agency	\$175,000
1997	U. S. Environmental Protection Agency (1997-1999)	\$250,000
1999	U. S. Environmental Protection Agency (1999-2001)	\$150,000
2001	United Nations Environment Program Plan (2001-2005)	\$250,000
2002	U.S. Environmental Protection Agency (2002-2005)	\$200,000
2002	U.S. Environmental Protection Agency (2002-2005)	\$150,000
2003	National Science Foundation (2003-2008)	\$1,500,000
2005	U.S. Environmental Protection Agency (2005-2007)	300,000

II. STATISTICAL DISTRIBUTIONS IN SCIENTIFIC WORK**

1963	National Research Council of Canada	\$15,000
1964-66	U. S. Air Force Office of Sci. Research	\$50,000
1973-76	NATO Scientific Affairs Division National Research Council of Canada U. S. Army Research Office University of Calgary National Institutes of Health	\$100,000
1980-81	NATO Scientific Affairs Division U. S. Office of Naval Research U. S. National Institutes of Health Consiglio Nazionale delle Ricerche, Italy Resione Autonoma Friuli, Venezia Giulia, Italy Universite di Trieste, Italy	\$100,000

III. NSF EQUIPMENT GRANTS IN THE DEPARTMENT

1991		\$30,000
1993		\$35,000
1995		\$35,000

*Partially Under the Auspices of the International Statistical Ecology Program (1971-1983), and the Penn State Center for Statistical Ecology and Environmental Statistics (1984-).

**Partially Under the Auspices of the International Committee on Statistical Distributions in Scientific Work, (1973-1981).

Continuously over the past three decades at Penn State, Professor Patil's funding stands at a highest level in the country for a faculty member in statistics. This page signifies the level of his funded research and training activity, and the recognition this funding implies.

Part 5: Recent Developments and Highlights

1. American Statistical Association, Master of Ceremony and Chair, Distinguished Achievement Medals, Statistics and the Environment, 1994

The American Statistical Association initiated the distinguished achievement medal awards in 1993. Professor Patil was recognized and honored to be an initial recipient together with ASA President Stuart Hunter of Princeton and McArthur Fellow John Bailar of McGill. Professor Patil was appointed Chair and the Master of Ceremonies for the 1994 Award Ceremony. N. Phillip Ross, the Chief Statistician of U.S. EPA was the Chief Guest.

2. International Association for Ecology, Master of Ceremony and Chair, Distinguished Statistical Ecologist Awards, International Ecological Congress, 1994

The International Association for Ecology initiated the distinguished statistical ecologist awards in 1986 at the International Ecological Congress held in USA. Professor Patil was the first and the only recipient of the award on the occasion. He was appointed Chair and Master of Ceremonies for the 1994 Award Ceremony at the International Ecological Congress held in U.K. Sir Richard Southwood and Sir Robert M. May of Oxford were among those who received the awards.

3. First French Conference on Ecology and Statistics, Niort, France, 1994

Professor Patil was invited to deliver the final keynote address to the First French Conference on Ecology and Statistics. The inaugural keynote was given by Professor Richard Cormack, former President of International Biometric Society, and Member of the Natural Environmental Research Council, UK. A special plenary was given by Professor Richard Tomassone of the University of Paris, himself also a former President of the International Biometric Society.

4. International Union of Forest Research Organizations, International Initiative on Measuring and Monitoring Biodiversity, Chiang Mai, Thailand, 1994

Professor Patil was invited to give a plenary lecture on statistical measurement and comparison of species diversity with application to the Inter-Agency International Initiative held in Chiang Mai, Thailand under the auspices of various national and international forest research organizations, inclusive of U.S. Forest Service. Invited participants included M. N. Salleh, IUFRO President and J. Burley, Oxford, a Fellow of Royal Society, UK.

5. Air and Waste Management Association, Keynote Inaugural Address, Washington, DC, 1995

Professor Patil is the first in statistics and mathematical statistics invited by the Air and Waste Management Association to deliver keynote inaugural address to their conference. Professor Patil spoke on a refreshing issue of innovative statistical mindsets and novel observational approaches to meet the challenges in the management of hazardous waste sites. Kenneth Olden, member of the U.S. National Academy of Sciences, and Director of the National Institute of Environmental Health Sciences gave a luncheon keynote address.

6. Ecological Society of China, ISEM-95 Vice President, Ecological Modeling Progress to Meet the Challenge of Sustainable Development, Beijing, China, 1995

The Ecological Society of China with Professor H. X. Yang, Academician of the Chinese Academy of Sciences as its Honorary President, recognized and honored Professor Patil in appointing him Vice-President of ISEM-95 along with S. E. Jorgensen, President, International Society of Ecological

Modeling and R. Costanza, President, International Society for Ecological Economics. Professor Patil was also invited to give a plenary lecture and the concluding keynote address.

7. International Biometric Society, First Biometric Conference of the Italian Region, Cortona, Italy, 1995

Professor Patil was invited to give a plenary lecture on ecological applications of generalized linear models and quasi-likelihood methods. Invited distinguished speakers included Norman Breslow of the University of Washington and K. Y. Liang of the Johns Hopkins University. The success of the speech has led to a special session at the 1996 Spring Statistics Meetings in USA with him as the session organizer and the discussant.

8. National Science Foundation, Cross-Disciplinary Research Grant Award, Statistical Multi-Scale Assessment of Watersheds and Landscapes, Principal Investigator 1995-1998

The NSF ranked Professor Patil's grant proposal in a competition for watersheds and landscapes research in the top 31 among 655 with the funding level being the 4th highest evenly shared by the NSF Mathematical Sciences and Environmental Biology Divisions. Professor Patil was the Principal Investigator. Professor Wayne Myers of the School of Forest Resources and the Center for Remote Sensing of the Environmental Resources Research Institute was Co-Principal Investigator. Professor Arkady Tempelman of Mathematics and Statistics was Co-Investigator. The grant also funded three research associates and for three graduate research assistants, one each in spatial statistics, quantitative ecology, and stochastic hydrology.

9. North American Free Trade Agreement, EPA Initiative on Improved Environmental Statistics and Reporting, United States Delegate, 1995

Professor Patil has been a United States Delegate to NAFTA U.S. EPA Trilateral Initiative, since its inception in Mexico City in 1993. He participated in the 1995 Bi-National Workshop on Baseline Indicators for the U.S.-Mexico Border. United States is a lead country for the Trilateral Working Group on Training in Environmental Statistics. Professor Patil serves as a co-leader of this group.

10. White House Executive Order on Reinventing Environmental Regulation, EPA Center for Environmental Information and Statistics, 1995

In collaboration with some three hundred leading environmental and ecological scientists, statistical ecologists, and environmental statisticians--these included John Cairns, Jr., James Ware, and E.O. Wilson, the well-known sociobiologist and Pulitzer prize winner, and several others--Professor Patil led an initiative for a National Center for Statistical Ecology and Environmental Statistics--A Center Without Walls. N. Phillip Ross, Chief Statistician of U.S. EPA, chaired the Inter-Agency Committee. Enthused and equipped, he has succeeded in seeing the White House Executive Order on Reinventing Environmental Regulation contain the Initiative for EPA Center for Environmental Information and Statistics. And also recommendations from several quarters for a National Bureau of Environmental Statistics.

11. Environmental Protection Agency, Cooperative Research Grants, Center for Statistical Ecology and Environmental Statistics, Founder Director and Principal Investigator, 1995

During this year, two EPA cooperative research grants add up to \$250,000 over 12-month period. One is with the EPA Office of Policy, Planning, and Evaluation. The second one is with the Office of Research and Development.

During the 12-year period since its inception, the Center has brought in \$3,000,000 in cooperative research grants in statistical ecology and environmental statistics with Professor Patil as the principal

investigator--something exceptional in statistics and mathematical statistics.

Continuously over the past 30 years at Penn State, Professor Patil's funding stands at a highest level in the country for a faculty member in statistics. It signifies the level of his funded research and outreach activity, and the external recognition this funding implies.

12. U.S. EPA Observational Economy Series, Based on Research and Outreach of the Center for Statistical Ecology and Environmental Statistics, 1995

The EPA Observational Economy Series is a result of the research conducted under a cooperative agreement between the U.S. Environmental Protection Agency and the Pennsylvania State University Center for Statistical Ecology and Environmental Statistics.

The EPA grant entitled 'Research and Outreach on Observational Economy, Environmental Sampling and Statistical Decision Making in Statistical Ecology and Environmental Statistics' consists of ten separate projects in progress at the Penn State Center: 1) Composite Sampling and Designs; 2) Ranked Set Sampling and Designs; 3) Environmental Site Characterization and Evaluation; 4) Encounter Sampling; 5) Spatio-temporal Data Analysis; 6) Biodiversity Analysis and Monitoring; 7) Adaptive Sampling Designs; 8) Statistics in Environmental Policy and Regulation for Compliance and Enforcement; 9) Statistical Ecology and Ecological Risk Assessment; and 10) Environmental Statistics Knowledge Transfer, Outreach and Training.

The series is published by the Statistical Analysis and Computing Branch of the Environmental Statistics and Information Division in the EPA Office of Policy, Planning and Evaluation.

13. Inter-Agency EMAP Symposium, Monitoring, Assessment, and Science Policy, Chapel Hill, NC, 1995

Professor Patil was invited to be a moderator for statistics and design issues and a plenary speaker on innovative environmental resource sampling techniques at the inter-agency symposium on environmental monitoring and assessment program with emphasis on monitoring, assessment, and science policy. Invited distinguished moderators included Ellis Cowling, a member of the U.S. National Academy of Sciences.

14. Penn State Statistical Ecology and Environmental Statistics, Silver Jubilee Issue of COENOSES, 1995

In the words of its editor-in-chief, Laszlo Orloci, himself an internationally distinguished statistical ecologist, a member of the Hungarian Academy of Sciences, and a Fellow of the Royal Society of Canada:

•...The year 1994 marked the 25th year of statistical ecology with reference to the First International Symposium on Statistical Ecology held at Yale in 1969 with G. P. Patil, E. C. Pielou, and W. E. Waters as three co-chairs representing the fields of statistics, theoretical ecology, and applied ecology. ...

It was a wonderful feeling at the 1994 Manchester International Ecological Congress to witness a successful and impressive celebration of the Silver Jubilee of Statistical Ecology with Professor G. P. Patil as its chair and the master of ceremonies. ...

It is a great pleasure and honor for COENOSES to have Professor G. P. Patil, the founder and the father figure of statistical ecology, do this special statistical ecology issue in conjunction with the silver jubilee of statistical ecology. Interestingly, this is also the year when his home based programs in statistical ecology and environmental statistics at Penn State complete their 25 years. The papers for this issue have been reviewed and

revised with a view to introduce our readership to the research, training, and outreach program at the unique and well-known Penn State Center for Statistical Ecology and Environmental Statistics of which Professor Patil has been the founder director, principal investigator, and distinguished professor. •

15. The Pennsylvania State University, Department of Statistics, Inter-College Graduate Program in Ecology, Statistics 524--Ecometrics, 1995

Some twenty-five years ago, Professor Patil conceptualized and introduced a contemporary graduate course in Ecometrics. It is a required course for Quantitative Ecology option in the Inter-College Graduate Program in Ecology and for environmental statistics option in statistics.

For purposes of the special statistical ecology issue of COENOSES to celebrate the silver jubilee of Penn State Statistical Ecology and Environmental Statistics, five graduate students enrolled in Statistics 524 have prepared an invited paper on cross-disciplinarity of a statistical ecology and environmental statistics classroom at Penn State--a very refreshing and encouraging article indeed, reflecting on the innovative classroom approach of the instructor for productive crossdisciplinary content and the skill. The graduate student authors are: (1) M. Ghosh-Dastidar, Statistics; (2) G. D. Johnson, Quantitative Ecology; (3) R. Norris, Biostatistics; (4) J. Orsin, Environmental Statistics, and (5) S. Shirk, Biostatistics.

16. The Pennsylvania State University, Department of Statistics, International Research and Training, Collaboration Initiatives and Leadership, 1995

The Italian National Research Council has now begun to send its promising and young environmental statistics students to Penn State as visiting scholars and graduate interns:

(1) Loredana Di Consiglio, Rome; (2) Dario Gregori, Florence; (3) Matteo Grigoletto, Padova.; (4) Alessandra Capobianci, Rome; (5) Danila Filipponi, Chieti; (6) Carla Sciullo, Rome.

The Penn State-Poona U.S.-India collaboration in environmental statistics has successfully continued over the past ten years under a Penn State-Poona MOU signed by Penn State President Bryce Jordan and Vice-Chancellor of Poona, M. G. Bhide, member of the Indian National Science Academy. The research collaboration has been largely on the statistical design and analysis with composite samples with Professor S. D. Gore as a visiting research associate. There have been also reciprocal visits by interested faculty both in Poona and Penn State.

17. The Pennsylvania State University, Department of Statistics External Review, Strategic Planning Committee, 1995

Professor Patil served on the Strategic Planning Committee of the Department of Statistics in preparation for the external review of the Department. The External Review Committee included Bradley Efron, a member of the National Academy of Sciences, and Nicholas Winograd, Evan Pugh Professor of Chemistry. Everyone was enthused with an earlier news in the year that the Department has now moved into the top 20 in the country in the most recent NAS/NRC survey. The departmental initiatives in statistical ecology and environmental statistics under Professor Patil's leadership have helped enhance the standing and the visibility of the Department, both nationally and internationally.

18. The Pennsylvania State University, University Future Committee, Environmental Science and Technology Council, Risk Assessment Consortium Initiative, 1995

As the group leader of the risk assessment consortium initiative, Professor Patil made a presentation to the Council, and to the Provost and the Senior Vice-President for Research and Graduate Education. The Initiative was generally well received. It was under active consideration for university support as part of the initiative of the Council. Potential Advisory Board under consideration was: John C. Bailar, III, John Cairns, Jr., Rita Colwell, Bernard Goldstein, Robert Goodland, John Graham, Gene Likens,

Frederick Mosteller, Jonathan Plaut, Paul Portney, C. R. Rao, Jerome Sacks, Rogbert Sokal, Sir Richard Southwood, and Ron Wyzga

19. *International Biometric Society, 50th Anniversary Celebration, Advances in Biometry Volume, 1996*
In company with Bradley Efron and C. R. Rao, members of the U. S. National Academy of Sciences, and distinguished biometricians, such as, James H. Ware, Mosteller Professor of Biostatistics at Harvard, and Peter Diggle, Editor of the Journal of Royal Statistical Society, Professor Patil was invited among some twenty select few to contribute an authoritative review article for the 50th anniversary volume. Professor Patil has just finished his panoramic overview of statistical ecology, environmental statistics, and risk assessment.

20. *Swiss Federal Institute of Technology, Assessment of Biodiversity for Improved Forest Planning, Monte Verita, Ascona, Switzerland, 1996*
Professor Patil has been invited to give a plenary lecture on statistical ecology and biodiversity issues at the Monte Verita Conference organized by Swiss Federal Institute of Technology in collaboration with European Forest Institute. Distinguished invitees include: M. Collins, Cambridge, UK; G. Z. Gertner, Urbana, IL; and J. T. Vanclay, CIFOR, Indonesia.

21. *National Institute of Ecology, India, First Indian Ecological Congress, New Delhi, India 1996*
Professor Patil has been invited to give a plenary lecture to the Congress on current perspectives in statistical ecology using geographic information systems. Invitees to give plenary lectures include Peter Raven, Director, Botanic Garden, St. Louis, member of the U. S. National Academy of Sciences and Chair, National Science Board, and Madhav Gadgil, Director, Center for Ecological Sciences, Bangalore, India, and a foreign member of the U.S. National Academy of Sciences.

22. *International Statistical Institute, Standing Committee on Environmental Statistics Vice-Chair, 1996*
Professor Patil has been a founder member of the standing committee on environmental statistics of the International Statistical Institute. Vic Barnett (UK), the Founder Chair, has invited Professor Patil to serve as Vice-Chair of the Committee, starting 1996.

23. *International Society for Ecosystem Health, Ecological Summit, Copenhagen, Denmark, 1996*
Professor Patil was invited to give a special lecture on statistical ecology and ecosystem health at the Ecological Summit planned by the International Society for Ecosystem Health in collaboration with International Society for Ecological Modeling, International Society for Ecological Economics, and International Society for Wetlands and Water Resources. Distinguished invitees include John Cairns, Jr., member of the National Academy of Sciences, and several other distinguished ecologists and environmental scientists.

24. *Statistics for the 21st Century, International Symposium, Bowling Green, Ohio, April 1998.*
Professor Patil was invited to give a plenary lecture in company with a select twenty outstanding statisticians, many of them members of their respective National Academy of Sciences. He spoke on environmental and ecological statistics for the 21st century at the evening banquet.

25. *UNEP Panel Meeting on Early Warning of Emerging Environmental Threats, Washington DC, December 1998.*
Professor Patil served on the United Nations Environment Program Panel on early warning of emerging

environmental threats with Panel Chair Mario Molina, Nobel Laureate and a member of U.S. President's Committee of Advisors on Science and Technology (PCAST), and helped prepare a draft guidance report on the theme of the Panel.

26. *Ninth Lukacs Symposium on Frontiers of Environmental and Ecological Statistics for the 21st Century, Bowling Green, Ohio, April 1999.*

Professor Patil convened this important timely symposium in association with International Statistical Institute, American Statistical Association, International Association for Ecology, International Society for Ecosystem Health, International Society for Ecological Economics, International Environmetrics Society, Society for Risk Analysis, United States Environmental Protection Agency, and United States Geological Survey. The participation was select, superb, and synergistic for cross-fertilization. The program layout was transparent and unique for the occasion. The major thrust was on synergistic challenges, opportunities and directions for statistics, ecology, environment, and society. Professor Patil was asked to give the inaugural keynote address. He emphasized the centrality for the new millennium looking for appropriate COMPASS, Combination of Practicality and Scholarship.

27. *Twentieth Century Distinguished Service Awards at the Ninth Lukacs Symposium, Bowling Green, Ohio, April 1999.*

Professor Patil was master of ceremony for these special awards for outstanding synergistic development of statistics, ecology, environment, and society in the form of statistical ecology, environmental statistics, environmental and ecological risk assessment or something more broad within the context. The awardees included John Cairns, Jr., Albert Gore, Jr., James Matis, Mario Molina, G. P. Patil, C. R. Rao, John Tukey, James Ware, E. O. Wilson, among others from within North America.

28. *Map of Italian Nature Project in the Office of the Italian Prime Minister: Collaborative Research Grant.*

Professor Patil has recently completed an extremely successful four year NSF/EPA cross-disciplinary research project on statistical approaches to multiscale assessment of landscapes and watersheds. The conceptualization and methodology have been well received with enthusiasm for their relevant sophistication and usefulness. Professor Patil has received a substantive grant for collaborative cross-disciplinary research, training, and outreach for the Map of Italian Nature Project in the Division of Technical Services of the Office of the Italian Prime Minister through the University of Parma, Parma, Italy.

29. *On the Go for Regional Policy Research with Remote Imagery, Geospatial Information, Landscape Fragmentation, and Spectral Change Detection, March 1999•October 1999.*

Professor Patil organized two sessions on 'Spatial Analysis in Ecology: Statistical Analysis of Remote Imagery in Landscape Ecology' at the 1999 Annual Meeting of the Association of American Geographers in Honolulu, Hawaii during March of 1999. He was the instructor for a short course on 'Environmental and Ecological Regional Policy Research with Remote Imagery and Geospatial Information' at the 44th Biometric Meeting of the Brazilian Region of the International Biometric Society in Botucatu, Sao Paulo, Brazil during July 1999. He was Organizer and Chair of an Invited Paper Meeting on 'Landscape and Watershed Frontier of Environmental and Ecological Statistics with Remote Sensing Data' at the 52nd International Statistical Institute Session held in Helsinki, Finland during August 1999. Also, in August, he was Organizer and Chair of 'Landscape Health Assessment Using Remote Imagery, Geospatial Information, and Landscape Fragmentation' at the International Congress on Ecosystem Health in Sacramento, California. Dr. Patil was the instructor for a short course on Landscape Approach to Environmental and Ecological Assessment at the International Biometrics Conference in La Plata, Argentina in October, 1999.

Part 6: Nineteen Ninety Distinguished Professor Nomination and Penn State President Response

Nomination by Clifford Clogg, Distinguished Professor of Sociology and Statistics.

Nomination by Keith Ord, David McKinley Professor of Management Science and Statistics.

Nomination by C. R. Rao, Eberly Professor of Statistics.

External References: John Cairns, Jr., Herman Chernoff, Sir David Cox, Sir Robert May, Frederick Mosteller, Marvin Zelen, among others.

Response by J. L. Thomas, Penn State President.

The College of Science Distinguished Professorship Selection Committee consisting of A. Welford Castleman, Chair, George Andrews, and Andrea Mastro solicited nominations. Professors Clogg, Ord, and Rao made the nominations in my behalf direct to the Committee, each one providing names of at least eight possible external referees, which very likely included the indicated names given above.

Department of Statistics
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25 September 1990

Dean Gregory Geoffrey
College of Science
211 Whitmore Lab
Pennsylvania State University
University Park, PA 16802

Dear Dean Geoffrey

I wish to nominate Professor G. P. Patil for the title and rank of Distinguished Professor. Please forward this letter and the enclosed documents to the appropriate committee. I enclose three copies of Patil's CV and three copies of a list of names of scholars who might be used as outside referees.

Patil's record is impressive and his contributions to theoretical statistics, to ecological statistics, and to the statistical profession at large are acknowledged throughout the world. The CV says all that and more. It would be impossible to survey the fields in which Patil works without noting that, in the vast majority of the cases, his work has changed the way that theoretical work is carried out and also has shaped the methodological landscape now regarded as familiar terrain in various applied areas. His work on the measurement and analysis of diversity, for example, has had a significant effect on the study of environmental problems and on the study of wildlife or fish populations (e.g., species abundance). I believe that external references (suggestions enclosed) would provide full documentation for these claims. I urge the selection committee to contact several of these scholars for details. Note that the list contains some of our best statisticians as well as some biological or environmental scientists of high stature.

Patil has had strong influence on statistics at Penn State. He was, for example, the most distinguished statistician at Penn State prior to the arrival of C. R. Rao, our Eberly Chair holder. Rao is one of the top two or three living statisticians; Patil was Rao's student and was one of the persons responsible for bringing Rao to PSU. We now have several world-class statisticians on our faculty besides Rao and Patil. But Patil is nevertheless our number two statistician in terms of reputation and visibility, and the fact that I have to rank him behind Rao is not intended to designate diminished status in an absolute sense. Patil has attracted strong group of scholars engaged in grant-and-contract work in statistical ecology. Patil has had a positive influence on all aspects of our program for many years—teaching, recruiting faculty and students, research, doing things that lead to external visibility, and the rest of it.

Patil is an organizer with considerable entrepreneurial talent, and this has to be taken into

account. How he manages his operations on top of his highly productive research program and along with his speaking or consulting engagements is hard to understand, but he is effective in anything he does. One case in point is the fact that he serves as chairman of the International Statistical Ecology Program, which, by the way, he helped to organize. Another case that the American Statistical Association recently formed a new section on Environmental Statistics and Statistical Ecology (my recollection of the exact name might be off). Patil had his hand in that (the name of the section is essentially the name of his research center!), and he will undoubtedly serve as an officer in that section in due course. He has been involved in organizing conferences, in organizing special sessions at conferences, and in bringing working groups together throughout the world, over a long period of time. There are few other statisticians anywhere who are invited to speak so often or asked to deliver keynote addresses so frequently at specialized conferences. His CV gives many more examples of his success as an organizer. What I hope it also says is that Patil has been an effective ambassador for statistical science throughout his illustrious career. These successes—on top of an enviable research record—indicate that Patil is already acknowledged as a distinguished scholar in the true sense of the term.

I am proud to be in the same department with Patil. A couple years ago I had the opportunity to introduce Patil in a special session held at statistics meeting in Boston, on the general topic of weighted distributions and meta-analysis. (Patil's work on weighted distributions is especially important, is recognized as the fundamental research in that area, and has implications for many different applied areas, including the "meta-analysis" of large number of similar experiments.) One of the other speakers was Fred Mosteller, a very distinguished Harvard professor and a member of the National Academy of Sciences. That day it was clear to everyone present that Patil belonged in a special session with Mosteller, that Mosteller and Patil were both regarded as distinguished members of the profession.

I support Patil for the title and award of Distinguished Professor with enthusiasm and without any reservations.

Sincerely,

Clifford C. Clogg
Distinguished Professor of Sociology &
Professor of Statistics

Part 7: Nineteen Ninety Four Evan Pugh Professor: Nomination and Penn State President Response

Nomination by C. R. Rao, Eberly Professor of Statistics and Director, Center for Multivariate Analysis.
Nomination by A. J. McDonnell, Professor of Environmental Engineering and Director, Environmental Resources Research Institute.

Response by J. L. Thomas, Penn State President.

1994 Nomination by C. R. Rao

It gives me great pleasure to nominate Professor G. P. Patil for an Evan Pugh Professorship at the Pennsylvania State University. I have known him for over thirty years first as my student and later as a collaborator in research work and professional colleague. His personal and professional contributions have been unique and take a variety of forms. A brief description of his academic career, scholarly contributions and professional activities is as follows.

Professor Patil was one of the few students admitted to the Indian Statistical Institute in 1955 for research work on the basis of the high academic distinction he achieved and the numerous prizes awarded to him for outstanding performance during his undergraduate and graduate studies at the University of Poona. He was rated as an outstanding scholar (top one percent) at the Indian Statistical Institute judged by the fundamental contributions he started to make in statistics within a short period after his admission. He went to the University of Michigan for further studies and received the Ph.D. degree in Mathematics in a record time. His thesis for the Ph.D. degree received acclamation for its originality, outstanding quality and usefulness in applied research work.

Professor Patil continued his academic pursuits over the years with great vigor and achieved a high degree of eminence in the field of statistics. He is a highly respected member of the statistical community and was honored by his election to the Fellowship of the most prestigious academic societies like the International Statistical Institute, American Statistical Association, Institute of Mathematical Statistics, American Association of Advancement of Science, Royal Statistical Society, Indian National Institute of Ecology, and the Indian Society for Medical Statistics. He is a first recipient of the distinguished achievement medal of the American Statistical Association for Statistics and the Environment. Professor Patil was the first person to receive the top distinction, the D.Sc. Degree of the Indian Statistical Institute in recognition of his pioneering and far-reaching contributions to theoretical statistics and their applications in scientific research. And, recently he was honored and invited to deliver the General Methodology Lecture to the Joint Annual Meetings of the Institute of Mathematical Statistics, the American Statistical Association, and the Biometric Society.

Special mention should be made of the unique expertise he has developed in statistical ecology for which his advice is sought by environmental agencies, industrial establishments and academic institutions. He has recently received "the most significant paper award" from the American Fisheries Society. He was the founder chairman of the International Statistical Ecology Program and is considered as the founder and father figure for statistical ecology. Largely due to his initiatives, the Ecological Society of America has initiated a Statistical Ecology Section and the American Statistical Association has initiated an Environmental Statistics Section of which he is the current chair. Also, partly triggered by his comprehensive NSF-STC proposal for the National Center for Statistical Ecology and Environmental Statistics, the U.S. Environmental Protection Agency is seriously considering to start a Bureau of Environmental Statistics and initiate a National Center.

The first distinguished statistical ecologist award has been made to Professor Patil by the International Association for Ecology for his outstanding and pioneering contributions to the development of basic concepts and applications of statistical ecology to the resolution of major issues and solutions of current problems in ecology. It is equally significant that Professor Patil has been awarded an Honorary Degree in Biological Sciences at the University of Parma, Parma, Italy--the first honorary degree that the University has given in its four hundred year history and also the first time that a scholar with a formal mathematical and statistical training has received an honorary degree in biological sciences. H. A. Hauptman, 1985 Nobel prize Winner in Chemistry, has been the recipient of the honorary degree at

Parma after Professor Patil. Professor Patil has been also awarded recently the Honorary Doctor of Letters Degree by the University of Poona, his alma mater. He is the first academic scientist ever to get this prestigious award from Poona.

Professor Patil has been extremely active in the dissemination of knowledge in statistics by organizing conferences, seminars and workshops, and publishing books. He is the author and co-author of over 200 research papers most of which are published in journals and specially edited volumes of international reputation. Professor Patil has edited many timely books which are valuable to students and research workers. The pioneering thirteen volume set on statistical ecology is well known worldwide. So, also the monumental three volume set of the Modern Dictionary and Classified Bibliography of Statistical Distributions in Scientific Work conceived and co-authored by him as the principal author shows the creative innovation and far reaching visions characteristic of this professional drive and achievement. To this distinguished list may be added the state of the art volume on multivariate environmental statistics and a comprehensive handbook of environmental statistics just published. And during this Silver Jubilee year of Statistical Ecology, Professor Patil has been invited to be the founding editor-in-chief of the new innovative journal, *Environmental and Ecological Statistics* initiated by a well-known publishing house with a prestigious editorial board.

Professor Patil is a perceptive expositor and lucid instructor. His courses involving statistical ecology, environmental statistics and statistical distributions in scientific work combine contemporary societal issues and the current statistical approaches. He has a knack for making complex and opaque matters simple and transparent. This may also be a reason for the success and the reputation of the only Center for Statistical Ecology and Environmental Statistics of which he has been the Founder Director. It is no wonder that several of his students and young associates are pursuing challenging interdisciplinary careers, and are eager and enthusiastic to participate in the programs that Professor Patil has planned. From time to time, Professor Patil likes to teach undergraduate courses in statistical thinking, biostatistics, and basic probability and statistics. He has been equally articulate and inspiring in the undergraduate classroom also.

Professor Patil has emerged as a pivotal figure in the area of environmental and ecological studies and research and earned the respect and admiration of the international scientific community. As a scholar of great depth and massive achievements, leader of research in an area of great importance to society and an inspiring teacher, Professor Patil richly deserves to be offered the prestigious Evan Pugh Professorship.

1994 Nomination by A. J. McDonnell

It is a great pleasure for me to nominate Professor G.P. Patil for the Evan Pugh Professorship. I have known and have had the opportunity to interact with Professor Patil for many years. Given the growing concerns for environmental issues and the awareness of the need for interdisciplinary statistics involvement, a strong nomination is only appropriate.

As the accompanying material will document, Dr. Patil has an impressive record of publications and professional activity. Internationally known, he has long promoted collaborative research between statistics and ecology. Many of his papers are jointly authored by individuals from multiple disciplines and cross the boundaries of probability and statistics into areas such as ecology and environmental science.

In interdisciplinary interaction, Professor Patil has been responsible for several pioneering symposia and advanced institutes resulting in valuable reference books. He is the Chairman of the India Task Force of the University and was instrumental in establishing the Penn State-Poona program for the exchange visits of faculty and students. I have personally participated in that program and found the experience to be professionally rewarding.

In service, Professor Patil has promoted both department and interdepartmental programs. He has been a founding member of the Intercollege Graduate Ecology Program at the University. He has promoted the Biometrics, Biostatistics, and Environmental Statistics programs in the Department of Statistics. Professor Patil serves on several boards and committees. For the initial five-year period, he was a member of the NOAA Chesapeake Bay Stock Assessment Committee as a representative of the Fish and Game Commission of the Commonwealth of Pennsylvania. During his tenure, he led an innovative research effort on the needed development and application of continuous and categorical multiple time series regression methods for the evaluation of the fluctuations in stock size variables in relation to the habitat quality, anthropogenic, and environmental variables.

Professor Patil is the founder and director of the Center for Statistical Ecology and Environmental Statistics. Recognizing the importance of having a university capability in this important area, I actively supported and endorsed the formation of that unit. Several faculty, affiliated with our Institute have and continue to participate in its programs.

Dr. Patil is a highly visible and respected member of the statistical community. He is a Fellow in a number of academic societies including the International Statistical Institute, American Statistical Association, Institute of Mathematical Statistics, American Association of Advancement of Science, Royal Statistical Society, Indian National Institute of Ecology, and the Indian Society for Medical Statistics. He is a first recipient of the distinguished achievement medal of the American Statistical Association for Statistics and the Environment. It is my understanding that Professor Patil was the first person to receive the top distinction, the D.Sc. Degree, of the Indian Statistical Institute in recognition of his pioneering and far-reaching contributions to theoretical statistics and their applications in scientific research. He was invited to deliver the General Methodology Lecture to the Joint Annual Meetings of the Institute of Mathematical Statistics, the American Statistical Association, and the Biometric Society.

Largely due to his initiatives, the Ecological Society of America has initiated a Statistical Ecology Section and the American Statistical Association has initiated an Environmental Statistics Section of which he is the current Chair. Also, partly triggered by his comprehensive NSF-STC proposal for the National Center for Statistical Ecology and Environmental Statistics, the U.S. Environmental Protection Agency is seriously considering creating a Bureau of Environmental Statistics and initiate a National Center.

He has received "the most significant paper award" from the American Fisheries Society. He was the first recipient of the distinguished ecologist award from the International Association for Ecology for his outstanding and pioneering contributions to the development of basic concepts and applications of statistical ecology to the resolution of major issues and solutions of current problems in ecology. Professor Patil was also awarded an Honorary Degree in Biological Sciences at the University of Parma, Parma, Italy - the first honorary degree that the University has given in its four hundred year history and also the first time that a scholar with a formal mathematical and statistical training has received an honorary degree in biological sciences. (Dr. H.A. Hauptman, 1985 Nobel Prize Winner in Chemistry has been the recipient of the honorary degree at Parma after Professor Patil.) Professor Patil has also been awarded the Honorary Doctor of Letters Degree by the University of Poona, his alma

mater. He is the first academic scientist ever to get this prestigious award from Poona.

Professor Patil has been extremely active in the dissemination of knowledge in statistics by organizing conferences, seminars and workshops, and publishing books. He is the author and co-author of over 200 research papers most of which are published in journals and specially edited volumes of international reputation. Professor Patil has edited many books which have provided significant resource material to students and researchers. Included in this output is a thirteen volume set on statistical ecology and a significant three volume set of the Modern Dictionary and Classified Bibliography of Statistical Distributions in Scientific Work. Recent state of the art assessments include a volume on Multivariate Environmental Statistics and a comprehensive Handbook of Environmental Statistics. Professor Patil has also been invited to be the founding editor-in-chief of a new Journal of Environmental and Ecological Statistics.

Professor Patil's contributions to statistical ecology cover a wide spectrum of research and publications. Statistical ecology is an evolving integrative area of research, and his personal research related to statistical ecology includes issues such as: models of species abundance, measurement and analysis of spatial patterns and distributions, recruitment abundance, measurement and analysis of spatial patterns and distributions, recruitment distributions in fisheries research, mathematical characterization of diversity profiles and community structure, size-biased sampling and modeling in observational studies, stochastic differential equation models of population abundance, and most recently, quantitative ecological risk analysis, for which he received a best paper award of the American Fisheries Society.

Surveys for monitoring changes and trends in our environment and its resources involve some unusual conceptual and methodological issues pertaining to the observer, the observed, and the Observational process. Professor Patil has pursued this important theme through his publications that relate to encounter sampling, encountered data, meta-analysis, and weighted distribution methods. To this end the American Statistical Association invited him to speak on these issues in their methodology lectures series.

Biodiversity is an issue area of growing importance and concern. As an example, the national forest management act requires that management practices maintain the diversity of forest ecosystems. The measurement and comparison of diversity has been an issue that Dr. Patil has addressed in several of his publications.

Professor Patil's contributions to environmental statistics address several important issues including environmental monitoring and sampling, environmental assessment, observational economy, superfund site characterization and evaluation and improved environmental statistics and reporting.

With regard to the latter issue, he was recently invited to be a U.S. delegate to the first NAFTA-related trilateral meeting on environmental statistics and reporting.

Statistical distributions remain an important and focal area of study. In this area, Dr. Patil has been involved with the issue of the analysis of small and skew data in conjunction with the evaluation of hazardous waste site remediation.

Policy pertaining to environmental protection and remediation is an evolving entity. The development and application of rigorous quantitative methods for the assessment of environmental change is critical to such policy development. Dr. Patil's work clearly relates and is important to such development.

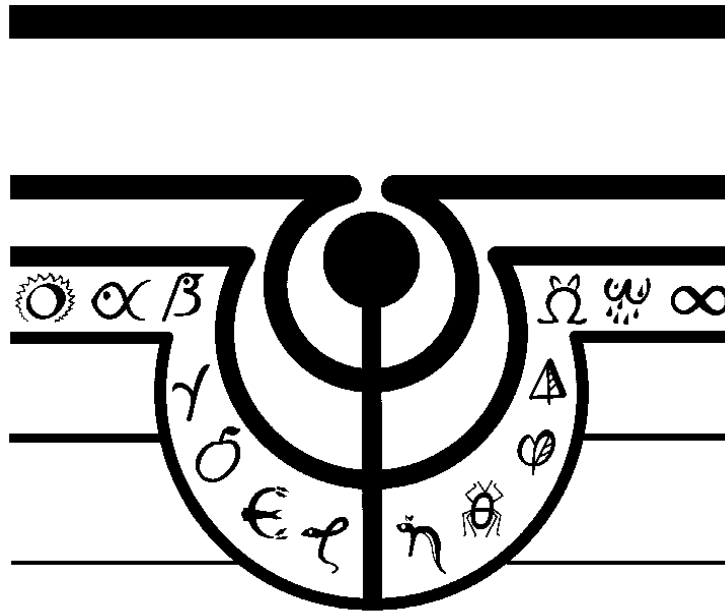
Given his extensive record of achievement and significant visibility in the field, Professor Patil represents an excellent candidate for the Evan Pugh Professorship and also richly deserves the prestigious award.

Part 8: Logo for Statistics, Ecology, Environment, and Society

The symbol design has a very insightful and unique logo suggestive of its function and the mission for cross-disciplinary synergism of statistics, ecology, environment, and society.

Conceptualized by G. P. Patil for Statistical Ecology and Environmental Statistics and designed by Yeshwant Chaudhary, former President of Indian Society for Industrial Design, the symbol design has won a first-place award in a Communication Artists' Guild. The symbol design visualizes the graphic concept of the Earth and establishes the harmonious environment between humankind and ecological beings in statistical symbols.

Still interesting is the rhythm achieved between the gradation of spaces and the thickness of lines weaving through each other into a total structural harmony. This symbol is appreciated world over for the design thinking that has gone into its expressing the message of statistical ecology and environmental statistics, signifying the role and use of statistical science in the sustainability of ecological productivity and environmental capacity.



Part 9: Multiscale Advanced Raster Map Analysis System Initiative for Digital Government in the 21st Century

Consider a 21st Century digital government scenario of the following nature: What message does a remote sensing-derived land cover land use map have about the large landscape it represents? And at what scale and at what level of detail?...Does the spatial pattern of the map reveal any societal, ecological, environmental condition of the landscape? And therefore can it be an indicator of change?...How do you automate the assessment of the spatial structure and behavior of change to discover critical areas, hot spots, and their corridors?...Is the map accurate? How accurate is it? How do you assess the accuracy of the map? Of the change map over time for change detection? What are the implications of the kind and amount of change and accuracy on what matters, whether climate change, carbon emission, water resources, urban sprawl, biodiversity, indicator species, or early warning? And with what confidence, even with a single map/change-map? ...The needed research is expected to find answers to these questions and a few more that involve multicategorical raster maps based on remote sensing and other geospatial data. It is also expected to design a prototype user-friendly advanced raster map analysis system for digital governance.

Part 10: Proposed UNEP Human Environment Index

UNITED NATIONS ENVIRONMENT PROGRAM
Nationwide Human Environment Index Worldwide

--Under Construction--

UNEP SCIENCE ADVISORY BOARD
Chair: Nobel Laureate Mario Molina

ENLIGHTENING HIGHLIGHTS ENLIGHTENED

The law of human life, living, and human life cycle lies in supportive land, air, and water (LAW). Ancient scriptures express it very well:

“...when the land is not livable,
when the air is not breathable,
when the water is not drinkable,
man shall perish...”

The worldwide human perception of the above comes through intuitive perspective of green land, blue sky, and clean water. Now that nationwide data have become available worldwide to help consider perceptive measures of greenness of land, blueness of sky, and cleanness of water, it is now possible to attempt to formulate and quantify a composite human environment index as a simple, elegant, and defensible societal instrument for national citizenry to discuss, debate and deal with human-environment interface in a public policy and planning arena. A most important purpose that such a human environment index is expected to serve is to help stimulate national and international dialogue leading to indepth policy discussion and debate essential for sustainable environment and development.

G. P. Patil, Member
UNEP Science Advisory Board

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ENLIGHTENING HIGHLIGHTS ENLIGHTENED

A major purpose of this study is to explore, investigate, and evaluate the proposed human environment index in light of any alternatives based on the concepts, methods, and tools available in the literature of individual indicators and integrated indicators.

For human species and humanity, each of the environmental component land, air, and water is as important as another, and it is not possible to speak of one being more important than the other. This leads to the concept of equal importance of each component, and to the concept of equal weight to each component –a concept potentially useful in the construction of a composite indicator.

The three basic individual component indicators are essentially uncorrelated and orthogonal in light of their largely uncorrelated columns. Therefore, their unweighted sum/average has no danger of allotting inadvertent importance to one over the other.

Each basic individual component indicator is a bonafide fractional proportion between zero and one. It is dimensionless, being a ratio of a part to the whole in the same units. The unweighted sum/average does not involve adding apples and oranges. And this approach can be satisfactory as long as the parts and the wholes represent satisfactory entities for which commensurate data are available, nationwide and worldwide.

Beauty lies in the eyes of the beholder. And that makes the difference. Indicators choice and their composites therefore become crucial when we view the environment in terms of landview, skyview, and waterview involving air, water, food, and shelter for the life support system for the humanity as we have known.

G. P. Patil, Member
UNEP Science Advisory Board