

D. References Cited

References Cited for Proposed Research 2.1 and 2.4

- Agresti, A. *Categorical Data Analysis*. Wiley, New York, 1990, 1996.
- Andersen, E. B. *The Statistical Analysis of Categorical Data*. Springer-Verlag, New York, 1994.
- Arrow, K., Bolin, B., Costanza, R., Dasgupta, P., Folke, C., Holling, C.S., Jansson, B-O., Levin, S., Maler, K., Perrings, C., Pimentel, D. Economic growth, carrying capacity and the environment. *Science*, **268**, 520–521, 1995.
- Bardossy, A., Duckstein, L. *Fuzzy Rule-Based Modeling with Applications to Geophysical, Biological and Engineering Systems*. CRC Press, Boca Raton, 1995.
- Basharin, G. P. (1959). On a statistical estimate for the entropy of a sequence of independent random variables. *Theory of Probability and its Applications*, 4, 333–336, 1959.
- Berman, A., and Plemmons, R. J. *Nonnegative Matrices in the Mathematical Sciences*. Siam, Philadelphia, 1994.
- Bishop, Y. M. M., Fienberg, S. E., and Holland, P. W. *Discrete Multivariate Analysis: Theory and Practice*. MIT Press, Cambridge, MA, 1975.
- Bissonnette, J. A. (ed). *Wildlife and Landscape Ecology: Effects of Patterns and Scale*. Springer, New York, 1997.
- Boswell, M. T., O'Connor, J., and Patil, G. P. A crystal cube for coastal and estuarine degradation: Selection of endpoints and development of indices for use in decision making. In *Handbook of Statistics Volume 12: Environmental Statistics*, G. P. Patil, and C. R. Rao (eds). North Holland/Elsevier Science Publishers, New York and Amsterdam. pp. 771-790, 1994.
- Boughton, D. A., Smith, E. R., and O'Neill, R. V. Regional vulnerability: na conceptual framework. *Ecosystem Health*, **5**(4), 312–322, 1999.
- Brauning, D. W., ed. *Atlas of Breeding Birds in Pennsylvania*. University of Pittsburgh Press, Pittsburgh, PA, 1992.
- Bremaud, P. *Markov Chains: Gibbs Fields, Monte Carlo Simulation, and Queues*. Springer, New York, 1999.
- Cairns Jr., J and Pratt, J. R.. The relationship between ecosystem health and delivery of ecosystem services, In: D.J. Rapport, C. Gaudet and P. Calow (eds), *Evaluating and Monitoring the Health of Large-Scale Ecosystems*, pp. 273-294. Springer-Verlag, Heidelberg, 1995.
- Christakos, G., and Hristopulos, D. T. *Spatiotemporal Environmental Health Modelling*. Kluwer, Boston, MA, 1998.
- Costanza, R. (ed). *Ecological economics: the science and management of sustainability*. Columbia University Press, New York, 1991.

- Costanza, R. Toward an operational definition of ecosystem health. In *Ecosystem Health: New Goals for Environmental Management*, R. Costanza, B. G. Norton, and B. D. Haskell, eds. Island Press, Washington. Pp 3-19, 1992.
- Costanza, R., Mageau, M., Norton, B., and Patten, B. C. What is sustainability? In *Ecosystem Health*, D. Rapport, *et al.* , eds. Blackwell Science, Malden, MA, pp. 31–239, 1998a.
- Costanza, R., Mageau, M., Norton, B., and Patten, B. C. Predictors of ecosystem health. In *Ecosystem Health*, D. Rapport, *et al.* , eds. Blackwell Science, Malden, MA, pp. 240–250, 1998b.
- Costanza, R., and Maxwell, T. Resolution and predictability: An approach to the scaling problem. *Landscape Ecology*, **9**, 47–57, 1994.
- Cressie, N. A. C. *Statistics for Spatial Data*. John Wiley & Sons, New York, 1991.
- Daily, G. (ed). *Nature's Service: Societal Dependence on Natural Ecosystems*. Island Press, Washington, 1997.
- DeSoyza, A. G., Whitford, W. G., and Herrick, J. E. Sensitivity testing of indicators of ecosystem health. *Ecosystem Health*, **3(1)**, 44–53, 1997.
- Dubois, D., Prade, H. *Fuzzy Sets and Systems: Theory and Applications*. Academic Press, New York, 1980.
- Filar, J. A., Ross, N. P., and Wu, M. L. Environmental assessment based on multiple indicators. CEIS, U.S. EPA, Washington, DC, pp. 1–30, 1999.
- Forman, R. T. T., and Godron, M. *Landscape Ecology*. John Wiley & Sons, New York, 1986.
- Frohn, R. C. *Remote Sensing for Landscape Ecology: New Metric Indicators for Monitoring, Modeling and Assessment of Ecosystems*. Lewis, Boca Raton, 1998.
- Gardner, R. H., O'Neill, R. V., and Turner, M. G. Ecological implications of landscape fragmentation. In *Humans as Components of Ecosystems, The Ecology of Subtle Human Effects and Populated Areas*. M. J. McDonnell and S. T. A. Pickett, eds. Springer-Verlag, New York, 1993.
- Geman, S. and Geman, D. Stochastic relaxation, Gibbs distribution, and the Bayesian restoration of images. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, **6**, 721–741, 1984.
- Graham, R. L., Hunsaker, C. T., O'Neill, R. V. Ecological risk assessment at the regional scale. *Ecological Applications*, **1**, 196–206, 1991.
- Grossi, L., Zurlini, G., and Rossi, O. Statistical detection of multiscale landscape patterns. *Ecological and Environmental Statistics*, 2000. (To appear).
- Guttorp, P. *Stochastic Modeling of Scientific Data*. Chapman & Hall, London, 1995.

- Guyon, X. *Random Fields on a Network: Modeling, Statistics, and Applications*. Springer-Verlag, New York, 1995.
- Hansen, A. J., and di Castri, F. (eds). *Landscape Boundaries.: Consequences for Biotic Diversity and Ecological Flows*. Springer-Verlag, New York, 452 pp, 1992.
- Hargis, C. D., Bissonette, J. A., and David, J. L. Understanding measures of landscape pattern. In *Wildlife and Landscape Ecology: Effects of Pattern and Scale*. J. A. Bissonette, ed. Springer, New York, pp. 231–261, 1997.
- Hargis, C. D., Bissonette, J. A. and David, J. L. The behavior of landscape metrics commonly used in the study of habitat fragmentation. *Landscape Ecology*, **13**, 167–186, 1998.
- Hartfiel, D. J. *Markov Set Chains*. Springer, New York, 1998.
- Hilden, M. and Rapport, D. J. Four centuries of cumulative impacts on a Finnish river and its estuary; an ecosystem health approach. *J. Aquatic Ecosystem Health*, **2**, 261–275, 1993.
- Joao, E. M. *Causes and Consequences of Map Generalisation*. Taylor & Francis, 1998.
- Johnson, G. D. *Landscape Pattern Analysis for Assessing Ecosystem Condition: Development of a Multi-Resolution Method and Application to Watershed Delineated Landscapes in Pennsylvania*. Ph.D. Thesis, The Pennsylvania State University, University Park, PA, 1999.
- Johnson, G. D., Myers, W. L., and Patil, G. P. Stochastic generating models for simulating hierarchically structured multi-cover landscapes. *Landscape Ecology*, **14**, 413–421, 1999.
- Johnson, G. D., Myers, W. L., and Patil, G. P. Predictability of surface water pollution loading in Pennsylvania using watershed-based landscape measurements. *Journal of the American Water Resources Association*, 2000. (Submitted)
- Johnson, G. D., Myers, W. L., Patil, G. P., and Taillie, C. Multiresolution fragmentation profiles for assessing hierarchically structured landscape patterns. *Ecological Modeling*, **116**, 293–301, 1999a.
- Johnson, G. D., Myers, W. L., Patil, G. P., and Taillie, C. Characterizing watershed-delineated landscapes in Pennsylvania using conditional entropy profiles. *Landscape Ecology*, 1999b. (Under revision).
- Johnson, G. D., Myers, W. L., Patil, G. P., and Taillie, C. Quantitative characterization of hierarchically scaled landscape patterns. *Environmental and Ecological Statistics*, 2000. (To appear).
- Johnson, G. D., Myers, W. L., Patil, G. P., and Walrath, D. Multiscale analysis of the spatial distribution of breeding bird species richness using the echelon approach. In *Assessment of Biodiversity for Improved Forest Planning*, P. Bachmann, M. Kohl, and R. Paivinen, eds. Kluwer Academic Publishers, pp. 135–150, 1998.
- Johnson, G. D., and Patil, G. P. Quantitative multiresolution characterizations of landscape patterns for assessing the status of ecosystem health in watershed management areas, *Ecosystem Health*, **4(3)**, 177–187, 1998.

- Jones, K. B., Riitters, K. H., Wickham, J. D., Tankersley, Jr., R. D., O'Neill, R. V., Chaloud, D. J., Smith, E. R., and Neale, A. C.. An ecological assessment of the United States Mid-Atlantic Region: A landscape atlas. EPA/600/R-97/130, United States Environmental Protection Agency, Office of Research and Development, Research Triangle Park, North Carolina, pp. 38–76, 1997.
- Kijima, M. *Markov Processes for Stochastic Modeling*. Chapman & Hall, London, 1997.
- Krummel, J. R., Gardner, R. H., Sugihara, G., O'Neill, R. V., and Coleman, P. R. Landscape patterns in a disturbed environment. *Oikos*, **48**, 321–324, 1987.
- Lange, K. *Numerical Analysis for Statisticians*. Springer, New York, 1999.
- Lapin, M., and Barnes, B. V. Using the landscape ecosystem approach to assess species and ecosystem diversity. *Conservation Biology*, **9**, 1148–1158, 1995.
- Leopold A. Wilderness as a land laboratory. *Living Wilderness*, **3**, 1941.
- Levin, S. The problem of pattern and scale in ecology. *Ecology*, **73**, 1943–1967, 1992.
- Levin, S. A., Grenfell, B., Hastings, A., Perrelson, A. S. Mathematical and computational challenges in population biology and ecosystem science. *Science*, **275**, 334–343, 1997.
- Lo, C. P. and Faber, B. J. (1997). Integration of Landsat Thematic Mapper and census data for quality of life assessment. *Remote Sensing of Environment*, **62**, 143–157.
- Lord, J. M., and Norton, D. A. Scale and the spatial concept of fragmentation. *Conservation Biology*, **2**, 197–202, 1990.
- Lunetta, R. S. and Elvidge, C. D. (eds). *Remote Sensing Change Detection: Environmental Monitoring Methods and Applications*. Ann Arbor Press, Ann Arbor, MI, 1998.
- Mageau, M.T., Costanza, R. and Ulanowicz, R.E. The development and initial testing of a quantitative assessment of ecosystem health. *Ecosystem Health*, **1**, 201–213, 1995.
- May, R. M. The effects of spatial scale of ecological questions and answers. In *Large Scale Ecology and Conservation Biology*, P. J. Edwards, R. M. May, and N. R. Webb, eds. Blackwell Scientific Publications, London, UK, 1994.
- McGarigal, K. and Marks, B. FRAGSTATS: Spatial pattern analysis program for quantifying landscape structure. General Technical Report PNW-GTR-351. Portland, OR, U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 1995.
- McKenzie, D. H., Hyatt, D. E., and McDonald, V. J. *Ecological Indicators, Volume 1*. Elsevier Applied Science, London and New York, 148 pp, 1992a.
- McKenzie, D. H., Hyatt, D. E., and McDonald, V. J. *Ecological Indicators, Volume 2*. Elsevier Applied Science, London and New York, 148 pp, 1992b.
- Meyn, S. P., and Tweedie, R. L. *Markov Chains and Stochastic Stability*. Springer-Verlag, London, 1993.

- Milne, B. T. Lessons from applying fractals models to landscape patterns. In *Quantitative Methods in Landscape Ecology*, M. G. Turner and R. H. Gardner, eds. Springer-Verlag, Berlin, 1991.
- Milne, B. T. Indications of landscape condition at many scales. In *Ecological Indicators, Volume 2*. D. H. McKenzie, D. E. Hyatt, V. J. McDonald, eds. Elsevier Applied Science, London and New York, pp 883–895, 1992.
- Myers, D. E. Matrix formulation of co-kriging. *Journal of the International Association for Mathematical Geology*, **14**, 249–257, 1982.
- Myers, W. L. PHASE approach to remote sensing and quantitative spatial data. Technical Report ER9710, Environmental Resources Research Institute, Pennsylvania State University, University Park, PA, 1997.
- Myers, W. L. Remote sensing and quantitative geogrids in PHASES [Pixel Hyperclusters As Segmented Environmental Signals], release 3.4. Technical report ER9901, Environmental Resources Research Institute, Penn State Univ., Univ. Park, PA 16802, 1999.
- Myers, W. L. Landscape scale ecological mapping of Pennsylvania forests. ER2002, Environmental Resources Research Institute, Penn State University, University Park, PA, 2000.
- Myers, W. L., Patil, G. P., and Taillie, C. Comparative paradigms for biodiversity assessment. Invited paper at the IUFRO Symposium in Chiang-mai, Thailand. In *Measuring and Monitoring Biodiversity in Tropical and Temperate Forests*, T. J. Boyle and B. Boontawee, eds. CIFOR, Bogor, Indonesia, pp. 67–85, 1995.
- National Research Council. *Our Common Journey: A transition toward sustainability*. National Academy Press, Washington, DC, 1999.
- Noss, R. F., Slosser, N. C., Strittholt, J. R., and Carroll, C. Some thoughts on metrics of ecological integrity for terrestrial ecosystems and entire landscapes. Advisory Report to EPA, pp. 1–124, 1999.
- O’Connell, T. J., Jackson, L. E., and Brooks, R. P. The bird community index: A tool for assessing biotic integrity in the mid-Atlantic highlands. Final report to U.S. EPA, No. 98-4, Penn State Cooperative Wetlands Center, Forest Resources Lab, Penn State University, University Park, PA, 1998.
- Olson, D. *Decision Aids for Selection Problems*. Springer, New York, 1996.
- O’Neill, R. V. Perspectives in hierarchy and scale. In *Perspectives in Ecological Theory*, J. Roughgarden, R. M. May, and S. A. Levin, eds. Princeton University Press, Princeton, NJ, 1989.
- O’Neill, R. V., DeAngelis, D. L., Waide, J. B., and Allen, T. F. H. *A Hierarchical Concept of Ecosystems*. Princeton University Press, Princeton, 1986.

- O'Neill, R. V., Hunsaker, C. T., Jones, K. B., Riitters, K. H., Wickham, J. D., Schwartz, P. M., Goodman, I. A., Jackson, B. L., and Baillargeon, W. S. Monitoring environmental quality at the landscape scale; using landscape indicators to assess biotic diversity, watershed integrity and landscape stability. *Bioscience*, **47**, 513–519, 1997.
- O'Neill, R. V., Hunsaker, C. T., Timmins, S. P., Jackson, B. L., Jones, K. B., Riitters, K. H., and Wickham, J. D. Scale problems in reporting landscape pattern at the regional scale. *Landscape Ecology*, **11**, 169–180, 1996.
- O'Neill, R. V., Johnson, A. R., King, A. W. A hierarchical framework for the analysis of scale. *Landscape Ecology*, **3**, 193–205, 1989.
- Osleeb, J. P., and Kahn, S. Integration of geographic information. In *Tools to Aid Environmental Decision Making*, V. H. Dale, and M. R. English, eds., Springer-Verlag, New York, 1999.
- Patil, G. P. Statistical ecology and environmental statistics for cost-effective ecological synthesis and environmental analysis. In *Modern Trends in Ecology and Environment*, R. S. Ambasht, ed. Backhuys Publ., The Netherlands, pp. 5–36, 1998.
- Patil, G. P., Johnson, G. D., Myers, W. L., and Taillie, C. Multiscale statistical approach to critical-area analysis and modeling of watersheds and landscapes. In *Statistics for the 21st Century: Methodologies for Applications of the Future*, C. R. Rao and G. J. Szekely, eds. Marcel Dekker, Inc., New York, pp. 293–310, 2000.
- Patil, G. P., and Myers, W. L. Guest Editorial: Environmental and ecological health assessment of landscapes and watersheds with remote sensing data: Toward the next generation of ecosystem and landscape health assessments. *Ecosystem Health*, **5(4)**, 221–224, 1999.
- Patil, G. P., Myers, W. L., Luo, Z., Johnson, G. D., and Taillie, C. Multiscale assessment of landscapes and watersheds with synoptic multivariate spatial data in environmental and ecological statistics. *Mathematical and Computer Modeling*, 1999. (In press).
- Patil, G. P., and Taillie, C. A Markov model for hierarchically scaled landscape patterns. In *Bull. of the International Statistical Institute*, Volume 58, Book 1. pp. 89–92, 1999.
- Pearson, S. M., and Gardner, R. H. Understanding neutral models: Useful tools for standing landscape patterns. In *Wildlife and Landscape Ecology: Effects of Pattern and Scale*, J. A. Bissonette, ed. Springer, New York, pp. 215–230, 1997.
- Quattrochi, D. A., and Goodchild, M. F. (eds) *Scale in Remote Sensing and GIS*. Lewis Publishers, Boca Raton, 1997.
- Radermacher, W. Indicators, green accounting and environment statistics—Information requirements for sustainable development. *International Statistical Review*, **67(3)**, 339–354, 1999.
- Rapport, D. J. Symptoms of pathology in the G'ulf of Bothnia (Baltic Sea): ecosystem response to stress from human activity. *Biol. J. Linn. Soc.*, **37**, 33–40, 1989.
- Rapport, D. J. Editorial: Ecosystem health, ecological integrity, and sustainable development: Toward consilience. *Ecosystem Health*, **4(3)**, 145, 1998.

- Rapport, D. J., Christensen, N., Karr, J. R., and Patil, G. P. The centrality of ecosystem health in achieving sustainability in the 21st century: Concepts and New Approaches to Environmental Management. *Human Survivability in the 21st Century: Transactions of the Royal Society of Canada*, University of Toronto Press, pp. 3–40, 1999.
- Rapport, D. J., Costanza, R., and McMichael, A. J. Assessing ecosystem health: Challenges at the interface of social, natural and health sciences. *Trends in Research in Evolution and Ecology*, **13**, 397–402, 1998.
- Rapport, D. J., Hilden, M. and Roots, E. F. Transformation in arctic ecosystems under stress. In *Disturbance and Recovery in Arctic Lands: An Ecological Perspective*, R. M. M Crawford, ed., Kluwer, pp. 73–90, 1997.
- Rapport, D. J., Hilden, M., and Wepping, K. Restoring the health of the earth's ecosystems: A new challenge for the earth sciences. *Episodes*, 2000. (In press)
- Rapport, D. J., Regier, H. A., and Hutchinson, T. C. Ecosystem behaviour under stress. *Am. Naturalist*, **125**, 617–640, 1985.
- Rapport, D. J. and Whitford, W. G. How ecosystems respond to stress: Common properties of arid and aquatic systems. *BioScience*, **49(3)**, 193–203, 1999.
- Rauscher, H. M., and Hacker, R. Overview of artificial intelligence applications in natural resource management. *J. Knowledge Engineering*, **2**, 30–42, 1989.
- Riitters, K. H., O'Neill, R. V., Hunsaker, C. T., Wickham, J. D., Yankee, D. H., Timmins, S. P., Jones, K. B. and Jackson, B. L. A factor analysis of landscape pattern and structure metrics. *Landscape Ecology*, **10**, 23–29, 1995.
- Riitters, K. H., O'Neill, R. V., and Jones, K. B. Assessing habitat suitability at multiple scales: A landscape-level approach. *Biological Conservation*, **81**, 191–202, 1997.
- Robert, C. P., and Casella, G. *Monte Carlo Statistical Methods*. Springer, New York, 1999.
- Saaty, T. L. *Decision Making for Leaders: The Analytic Hierarchy Process for Decisions in a Complex World* (1999/2000 edition), 3rd rev. ed., vol. 2, RWS Publications, Pittsburgh, 1999.
- Schinazi, R. B. *Classical and Spatial Stochastic Processes*. Birkhauser, Boston, 1999.
- Schumaker, N. H. Using landscape indices to predict habitat connectivity. *Ecology*, **77(4)**, 1210–1225, 1996.
- Scott, J. M., Csuti, B., Smith, K., Estes, J. E., and Caicco, S. Gap analysis of species richness and vegetation cover: an integrated conservation strategy for the preservation of biological diversity. In *Balancing on the Brink: A Retrospective on the Endangered Species Act*. Island Press, Washington, DC, 1990.
- Scott, J. M., Davis, F., Csuti, B., Noss, R., Butterfield, B., Groves C., anderson, H., Caicco, S., D'Erchia, F., Edwards, T. C., Ulliman, J., and Wright, G. Gap analysis: a geographic approach to protection of biological diversity. *Wildlife Monographs*, 123, 1993.

- Serfozo, R. *Introduction to Stochastic Networks*. Springer, New York, 1999.
- Sexton, W. T., Malk, A. J., Szaro, R. C., and Johnson, N. C. (eds). *Ecological Stewardship: A Common Reference for Ecosystem Management, Volume III*. Elsevier Science, Oxford, UK, 1999.
- Sinclair, A. *Algorithms for Random Generation and Counting: A Markov Chain Approach*. Birkhauser, Boston, 1993.
- Stehman, S. Thematic map accuracy assessment from the perspective of finite population sampling. *Int. J. Remote Sensing*, **16(3)**, 589–593, 1995.
- Stehman, S. Use of auxiliary data to improve the precision of estimators of thematic map accuracy. *Remote Sens. Environ.*, **58**, 169–176, 1996.
- Stehman, S. Selecting and interpreting measures of thematic classification accuracy. *Remote Sens. Environ.*, **62**, 77–89, 1997.
- Stewart, W. J. Numerical methods for computing stationary distributions of finite irreducible Markov chains. In *Computational Probability*, W. K. Grassmann, ed. Kluwer, Boston, pp. 81–110, 2000.
- Szaro, R. C., Johnson, N. C., Sexton, W. T., and Malk, A. J. (eds). *Ecological Stewardship: A Common Reference for Ecosystem Management, Volume II*. Elsevier Science, Oxford, UK, 1999.
- Tempelman, A. Multiscale analysis of patterns, Part 1: Self-similar random multiscale processes and their dimensions. Technical Report 99-0202, Center for Statistical Ecology and Environmental Statistics, Department of Statistics, Penn State University, University Park, PA., 1999a.
- Tempelman, A. Dimension of random fractals in metric spaces. *Theory of Probability and Applications*, **44**, 1999b. (In press).
- Tran, L. T. and Duckstein, L. Comparison of fuzzy numbers using a fuzzy distance measure. *Environmental and Ecological Statistics* (In Review).
- Turner, M. G., and Gardner, R. H. (eds). *Quantitative Methods in Landscape Ecology*. Springer-Verlag, New York, 1991.
- Turner, M. G., O'Neill, R. V., Gardner, R. H., and Milner, B. T. Effects of changing spatial scale on the analysis of landscape pattern. *Landscape Ecology*, **3**, 153–162, 1989.
- Urban, D. L., O'Neill, R. V., and Shugart, H. H., Jr. Landscape ecology; a hierarchical perspective can help scientists understand spatial patterns. *Bioscience*, **37**, 119–127, 1987.
- Vitousek, P. M., Mooney, H. A., Lubchenco, J. and Milillo, J. M. Human domination of earth's ecosystems. *Science*, **277**, 494–499, 1997.
- White, D., Minotti, P. G., Barczak, M. J., Sifneos, J. C., et al. Assessing risks to biodiversity from future landscape change. *Conservation Biology*, **11(2)**, 349–360, 1997.

- Whitford, W. G. The desert grasslands. In *Ecosystem Health*, D. J. Rapport, R. Costanza, P. R. Epstein, F. C. Gaudet, and R. Levins, eds. Blackwell Science, pp 313–323, 1998a.
- Whitford, W. G. Validation of indicators. In *Ecosystem Health*, D. J. Rapport, R. Costanza, P. R. Epstein, F. C. Gaudet, and R. Levins, eds. Blackwell Science, pp 205–209, 1998b.
- Wichert, G. and Rapport, D. J. Fish community structure as a measure of degradation and rehabilitation of riparian systems in an agricultural drainage basin. *Environmental Management*, **22**, 425–443, 1998.
- Wiens, J. A. Spatial scaling in ecology. *Functional Ecology*, **3**, 385–397, 1989.
- Wilson, E. O. *Consilience: The Unity of Knowledge*. Knopf, NY, 332 pp., 1998.
- Winkler, G. *Image Analysis, Random Fields and Dynamic Monte Carlo Methods: A Mathematical Introduction*, Springer, New York, 1995.
- Yazvenko, S. B. and Rapport, D. J. The history of Ponderosa pine pathology: implications for management. *J. Forestry*, **95**, 16–20, 1997.
- Zadeh, L. A. Fuzzy sets. *Information and Control*, **8**, 338–353, 1965.
- Zeleny, M. *Multiple Criteria Decision Making*, McGraw-Hill, New York, 1982.
- Zimmerman, H. J. *Fuzzy Sets, Decision Making, and Expert Systems*. Kluwer Academic Publishers, Boston, 1987.

References Cited for Proposed Research 2.2, 2.3, and 2.5

- Agresti, A. (1996). *Categorical Data Analysis*. Wiley, New York.
- Andersen, E. B. (1994). *The Statistical Analysis of Categorical Data*. Springer-Verlag, New York.
- Biging, G. S., Colby, D. R., and Congalton, R. G. (1998). Chapter 15: Sampling systems for change detection accuracy assessment. In *Remote Sensing Change Detection: Environmental Monitoring Methods and Applications*, R. S. Lunnetta and C. D. Elvidge, eds. Ann Arbor Press, Chelsea, MI. pp. 281–308.
- Bishop, Y. M. M., Fienberg, S. E., and Holland, P. W. (1975). *Discrete Multivariate Analysis: Theory and Practice*. MIT Press, Cambridge, MA.
- Brauning, D. W., ed. (1992). *Atlas of Breeding Birds in Pennsylvania*. University of Pittsburgh Press, Pittsburgh, PA.
- Breidt, F. J. (1995a). Markov chain designs for one-per-stratum sampling. *Survey Methodology*, **21(1)**, 63–70.
- Breidt, F. J. (1995b). Markov chain designs for one-per-stratum spatial sampling. In *Proceedings of the Section on Survey Research Methods*, American Statistical Association, Washington, DC. pp. 356–361.

- Bremaud, P. (1999). *Markov Chains: Gibbs Fields, Monte Carlo Simulation, and Queues*. Springer, New York.
- Brown, D. G., Duh, J. D., and Drzyzga, S. (2000). Estimating error in an analysis of forest fragmentation change using North American Landscape Characterization (NALC) data. *Remote Sensing of Environment*, **71**, 106–117.
- Campbell, J. 1981. Spatial autocorrelation effects upon the accuracy of supervised classification of land cover. *Photogrammetric Engineering and Remote Sensing* Vol. 47, No. 3 pp. 355-363.
- Canters, F. (1997). Evaluating the uncertainty of area estimates derived from fuzzy land-cover classification. *Photogrammetric Engineering and Remote Sensing*, **63**, 403–414.
- Chrisman (1992). (Khorram 1999)
- Christman, M. C. (2000a). A review of quadrat-based sampling of rare, geographically clustered populations. *J. Agricultural, Biological, and Environmental Statistics*. (To appear).
- Christman, M. C. (2000b). Adaptive two-stage one-per-stratum sampling. *Environmental and Ecological Statistics*. (Submitted).
- Clapham, W. B., Jr., and Sgro, G. (2000). Remote sensing as an ecological tool in urban watersheds. Paper presented at ASPRS Annual Meetings, Washington, DC. Campbell, J. 1987. *Introduction to Remote Sensing*. Guilford Press, New York. 551 p.
- Cliff, A. D. and Ord, J. K. 1973. *Spatial Autocorrelation*. Pion Limited. London, England. 178 p.
- Cohen, J. 1960. A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*. Vol. 20, No. 1, pp. 37-46.
- Congalton, R. G. (1988). Using spatial autocorrelation analysis to explore errors in maps generated from remotely sensed data. *Photogrammetric Engineering and Remote Sensing*, **54(5)**, 587–592.
- Congalton, R. G. (1988b). A comparison of sampling schemes used in generating error matrices for assessing the accuracy of maps generated from remotely sensed data. *Photogrammetric Engineering and Remote Sensing*, **54(5)**, 595–600.
- Congalton, R. G., and Green, K. (1999). *Assessing the Accuracy of Remotely Sensed Data: Principles and Practices*. Lewis Publishers, Boca Raton, Fl.
- Congalton, R. G. and R. D. Macleod. 1994. Change detection accuracy assessment on the NOAA Chesapeake Bay Pilot Study. Proceedings of the International Symposium on the Spatial Accuracy of Natural Resources Data Bases. ASPRS. Williamsburg, VA, May 16-20, 1994, pp. 78-87
- Congalton, R. G., Oderwald, R. G., and Mead, R. A. 1983. Assessing Landsat classification accuracy using discrete multivariate statistical techniques. *Photogrammetric Engineering and Remote Sensing*. Vol. 49, No. 12, pp. 1671-1678.

- Costanza, R. (ed). (1991). *Ecological economics: the science and management of sustainability*. Columbia University Press, New York.
- Cressie, N. A. C. (1991). *Statistics for Spatial Data*. John Wiley & Sons, New York.
- EPA. (1997). The index of watershed indicators. EPA-841-R-97-010, United States Environmental Protection Agency, Office of Water, Wash., DC.
- Fisher, P. F., and Pathirana, S. (1993). The ordering of multitemporal fuzzy land-cover information derived from Landsat MSS data. *Geocarto International*, **8(3)**, 5–14.
- Fitzpatrick-Lins, K. 1981. Comparison of sampling procedures and data analysis for a land-use and land-cover map. *Photogrammetric Engineering and Remote Sensing*. Vol. 47, No. 3, pp. 343-351.
- Foody, G. M. (1996). Approaches for the production and evaluation of fuzzy land cover classifications from remotely-sensed data. *Int. J. Remote Sensing*, **17(7)**, 1317–1340.
- Foody, G. M., Palubinskas, G., Lucas, R. M., Curran, P. J., and Honzak, M. (1996). Identifying terrestrial carbon sinks: Classification of successional stages in regenerating tropical forest from Landsat TM data. *Remote Sens. Environ.*, **55**, 205–216.
- Fuller, W. A. (1999). Environmental surveys over time. *Journal of Agricultural, Biological, and Environmental Statistics*, **4(4)**, 331–345.
- Fung, T., and E. LeDrew. 1988. The determination of optimal threshold levels for change detection using various accuracy indices. *Photogrammetric Engineering and Remote Sensing*. Vol. 54, No. 10, pp. 1449-1454.
- Geman, S. and Geman, D.b (1984). Stochastic relaxation, Gibbs distribution, and the Bayesian restoration of images. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, **6**, 721–741.
- Ginevan, M. E. 1979. Testing land-use map accuracy: another look. *Photogrammetric Engineering and Remote Sensing*. Vol. 45, No. 10, pp. 1371-1377.
- Gopal, S., and Woodcock, C. (1994). Theory and methods for accuracy assessment of thematic maps using fuzzy sets. *Photogrammetric Engineering and Remote Sensing*, **60**, 181–188.
- Guyon, X. (1995). *Random Fields on a Network: Modeling, Statistics, and Applications*. Springer-Verlag, New York.
- Hord. R. M. and Brooner, W. 1976. Land use map accuracy criteria. *Photogrammetric Engineering and Remote Sensing*. Vol. 42, No. 5, pp. 671-677.
- Hudson, W. and C. Ramm. 1987. Correct formulation of the kappa coefficient of agreement. *Photogrammetric Engineering and Remote Sensing*. Vol. 53, No.4, pp. 421-422.
- Joao, E. M. *Causes and Consequences of Map Generalisation*. Taylor & Francis, 1998.

- Johnson, G. D., Myers, W. L., Patil, G. P., and Walrath, D. (1998). Multiscale analysis of the spatial distribution of breeding bird species richness using the echelon approach. In *Assessment of Biodiversity for Improved Forest Planning*, P. Bachmann, M. Kohl, and R. Paivinen, eds. Kluwer Academic Publishers, pp. 135–150.
- Jones, K. B., Riitters, K. H., Wickham, J. D., Tankersley, Jr., R. D., O'Neill, R. V., Chaloud, D. J., Smith, E. R., and Neale, A. C. (1997). An ecological assessment of the United States Mid-Atlantic Region: A landscape atlas. EPA/600/R-97/130, United States Environmental Protection Agency, Office of Research and Development, Research Triangle Park, North Carolina, pp. 38–76.
- Kalton, G., and Anderson, D. W. (1986). Sampling rare populations. *J. R. Statist. Soc. A.*, **149**(Part 1), 65–82.
- S. Khorram, G. S. Biging, N. R. Chrisman, D. R. Colby, R. G. Congalton, J. E. Dobson, R. L. Ferguson, M. F. Goodchild, J. R. Jensen, and T. H. Mace (1999). Accuracy assessment of remote sensing derived change detection. ASPRS Monograph Series, American Society for Photogrammetry and Remote Sensing. Bethesda, MD. pp. 64.
- Kijima, M. (1997). *Markov Processes for Stochastic Modeling*. Chapman & Hall, London.
- Kurihara, K., Myers, W. L., and Patil, G. P. (1999). The relationship of the population and land cover patterns in Tokyo area based on remote sensing data. Technical Report 99-1103, Center for Statistical Ecology and Environmental Statistics, Department of Statistics, Penn State University, University Park, PA.
- Kyriakidis, P. C., and Dungan, J. L. (2000). Assessing thematic classification accuracy and the impact of inaccurate spatial data on ecological model predictions. *Environmental and Ecological Statistics*. (Submitted).
- Lange, K. (1999). *Numerical Analysis for Statisticians*. Springer, New York.
- Lo, C. P., and Yang, X. (2000). Mapping the dynamics of land use and land cover change in the Atlanta metropolitan area using time sequential landsat images. Paper presented at ASPRS Annual Meetings, Washington, DC.
- Lunetta, R. S., and Elvidge, C. D. (1998). *Remote Sensing Change Detection: Environmental Monitoring Methods and Applications*, Ann Arbor Press, Chelsea, MI.
- Martin, L. R. G. 1989. Accuracy assessment of Landsat-based visual change detection methods applied to the rural-urban fringe. *Photogrammetric Engineering and Remote Sensing*. Vol. 55, pp. 209-215.
- McGarigal, K. and Marks, B. (1995). FRAGSTATS: Spatial pattern analysis program for quantifying landscape structure. General Technical Report PNW-GTR-351. Portland, OR, U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- Moisen, G. G., and Edwards, T. C., Jr. (1999). Use of generalized linear models and digital data in a forest inventory of Northern Utah. *Journal of Agricultural, Biological, and Environmental Statistics*, **4**(4), 372–390.

- Myers, D. E. (1982). Matrix formulation of co-kriging. *Journal of the International Association for Mathematical Geology*, **14**, 249–257.
- Myers, W. L. (1997). PHASE approach to remote sensing and quantitative spatial data. Technical Report ER9710, Environmental Resources Research Institute, Pennsylvania State University, University Park, PA.
- Myers, W. L. (1999). Remote sensing and quantitative geogrids in PHASES [Pixel Hyperclusters As Segmented Environmental Signals], release 3.4. Technical report ER9901, Environmental Resources Research Institute, Penn State Univ., Univ. Park, PA 16802.
- Myers, W. L. (2000). Landscape scale ecological mapping of Pennsylvania forests. ER2002, Environmental Resources Research Institute, Penn State University, University Park, PA.
- Myers, W. L., Patil, G. P., and Joly, K. (1997). Echelon approach to areas of concern in synoptic regional monitoring. *Environmental and Ecological Statistics*, **4(2)**, 131–152.
- Myers, W. L., Patil, G. P., and Taillie, C. (1995). Comparative paradigms for biodiversity assessment. Invited paper at the IUFRO Symposium in Chiang-mai, Thailand. In *Measuring and Monitoring Biodiversity in Tropical and Temperate Forests*, T. J. Boyle and B. Boontawee, eds. CIFOR, Bogor, Indonesia, pp. 67–85.
- Myers, W. L., Patil, G. P., and Taillie, C. (1999). Conceptualizing pattern analysis of spectral change relative to ecosystem health. *Ecosystem Health*, **5(4)**, 285–293.
- Nusser, S. M., and Goebel, J. J. (1997). The national resources inventory: A long-term multi-resource monitoring programme. *Environmental and Ecological Statistics*, **4**, 181–204.
- O’Neill, R. V., Hunsaker, C. T., Jones, K. B., Riitters, K. H., Wickham, J. D., Schwartz, P. M., Goodman, I. A., Jackson, B. L., and Baillargeon, W. S. (1997). Monitoring environmental quality at the landscape scale; using landscape indicators to assess biotic diversity, watershed integrity and landscape stability. *Bioscience*, **47**, 513–519.
- Opsomer, J. D., and Nusser, S. M. (1999). Sample designs for watershed assessment. *Journal of Agricultural, Biological, and Environmental Statistics*, **4(4)**, 429–442.
- Patil, G. P., and Taillie, C. (1999). Topological concepts and definitions for echelons and echelon trees. Technical Report 99-0602, Center for Statistical Ecology and Environmental Statistics, Department of Statistics, Penn State University, University Park, PA.
- Pickett, S. T. A. and White, P. S. (eds). (1985). *The Ecology of Natural Disturbance and Patch Dynamics*. Academic Press, Orlando, FL.
- Prisley, S., and Smith, J. (1987). Using classification error matrices to improve the accuracy of weighted land-cover models. *Photogrammetric Engineering and Remote Sensing*, **53(9)**, 1259–1263.
- Ramakomud, A. (1998). Change detection using hyperclustered data: the spatial averaging approach. Master of Science Thesis, Penn State Univ., Univ. Park, PA.

- Ricotta, C. and Avena, G. C. (1999). The influence of fuzzy set theory on the areal extent of thematic map classes. *International Journal of Remote Sensing*, **20**, 201–205.
- Riley, R. H., Phillips, D. L., Schuft, M. J., and Garcia, M. C. (1997). Resolution and error in measuring land-cover change: effects on estimating net carbon release from Mexican terrestrial ecosystems. *International Journal of Remote Sensing*, **18**, 121–137.
- Rodriguez-Iturbe, I., and Rinaldo, A. (1997). *Fractal River Basins: Chance and Self-Organization*. Cambridge University Press, Cambridge, UK, 547 pp..
- Rosenfield, G. and K. Fitzpatrick-Lins. 1986. A coefficient of agreement as a measure of thematic classification accuracy. *Photogrammetric Engineering and Remote Sensing*. Vol. 52, No. 2, pp. 223-227.
- Schinazi, R. B. (1999). *Classical and Spatial Stochastic Processes*. Birkhauser, Boston.
- Scott, J. M., Davis, F., Csuti, B., Noss, R., Butterfield, B., Groves C., anderson, H., Caicco, S., D’Erchia, F., Edwards, T. C., Ulliman, J., and Wright, G. (1993). Gap analysis: a geographic approach to protection of biological diversity. *Wildlife Monographs*, 123.
- Serfozo, R. (1999). *Introduction to Stochastic Networks*. Springer, New York.
- Singh, A. 1989. Digital change detection techniques using remotely-sensed data. *International Journal of Remote Sensing*. Vol. 10, No. 6, pp. 989-1003.
- Smits, P. C., and Myers, W. L. Echelon approach to characterize and understand spatial structures of change in multi-temporal remote-sensing imagery. *IEEE Trans. Geoscience and Remote Sensing*. (Under revision)
- Stehman, S. (1995). Thematic map accuracy assessment from the perspective of finite population sampling. *Int. J. Remote Sensing*, **16(3)**, 589–593.
- Stehman, S. V. (1996a). Use of auxiliary data to improve the precision of estimators of thematic map accuracy. *Remote Sens. Environ.*, **58**, 169–176.
- Stehman, S. V. (1996b). Cost-effective, practical sampling strategies for accuracy assessment of large-area thematic maps. In *Spatial Accuracy Assessment in Natural Resources and Environmental Sciences: Second International Symposium*. General Technical Report RM-GTR-277, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. pp. 485–492.
- Stehman, S. V. (1997a). Estimating standard errors of accuracy assessment statistics under cluster sampling. *Remote Sens. Environ.*, **60**, 258–269.
- Stehman, S. V. (1997b). Selecting and interpreting measures of thematic classification accuracy. *Remote Sens. Environ.*, **62**, 77–89.
- Stehman, S. V. (1999a). Basic probability sampling designs for thematic map accuracy assessment. *Int. J. Remote Sensing*, **20(12)**, 2423–2441.

- Stehman, S. V. (1999b). Comparing thematic maps based on map value. *Int. J. Remote Sensing*, **20**(12), 2347–2366.
- Stehman, S. V. (1999c). Estimating the kappa coefficient and its variance under stratified random sampling. *Photogrammetric Engineering and Remote Sensing*, **62**, 402–407.
- Stehman, S. V. (2000). Practical implications of design-based sampling inference for thematic map accuracy assessment. *Remote Sens. Environ.*, **72**, 35–45.
- Story, M. and Congalton, R. 1986. Accuracy assessment: A user's perspective. *Photogrammetric Engineering and Remote Sensing*. Vol. 52, No. 3, pp. 397-399.
- Thompson, S. K. (1982). *Adaptive Sampling of Spatial Point Processes*. Ph.D. Thesis, Oregon State University.
- Thompson, S. K. (1992). *Sampling*. John Wiley, New York.
- Thompson, S. K., and Seber, G. A. F. (1996). *Adaptive Sampling*. John Wiley and Sons, New York.
- Tortora, R. 1978. A note on sample size estimation for multinomial populations. *The American Statistician*. Vol. 32., No. 3. pp. 100-102.
- Wagner, T. W. (2000). Mapping urban carbon dynamic with Landsat data: A Detroit study. Paper presented at ASPRS Annual Meetings, Washington, DC.
- Wang, F. (1990). Improving remote sensing image analysis through fuzzy information representation *Photogrammetric Engineering and Remote Sensing*, **56**(8), 1163–1169.
- Wang, F. (1993). A knowledge-based vision system for detecting land changes at urban fringes. *IEEE Transactions on Geoscience and Remote Sensing*, **31**, 136–145.
- Wickham, J. D., O'Neill, R. V., and Jones, K. B. (2000). Forest fragmentation as an economic indicator. *Landscape Ecology*, **15**(2), 171–179.
- Winkler, G. (1995). *Image Analysis, Random Fields and Dynamic Monte Carlo Methods: A Mathematical Introduction*, Springer, New York.
- Woodcock, C., and Gopal, S. (1992). Accuracy assessment of the Stanislaus Forest vegetation map using fuzzy sets. In *Proceedings of the 4th Forest Service Remote Sensing Conference: Remote Sensing and Natural Resource Management*, Orlando, Fl. pp. 378–394.
- Woodcock, C., and Gopal, S. (2000). Fuzzy set theory and thematic maps: accuracy assessment and area estimation. *Int. J. Geographical Information Science*, **14**(2), 153–172.
- Wrigley, N. (1985). *Categorical Data Analysis in Geography*. Arnold, London.
- Zhu, A. X. (1997). Measuring uncertainty in class assignment for natural resource maps under fuzzy logic. *Photogramm. Eng. Remote Sens.*, **63**, 1195–1202.