

Song S. Qian

Department of Environmental Sciences
The University of Toledo

EDUCATION

Ph.D. Environmental Sciences. 1995. Duke University
M.S. Statistics. 1995. Duke University
M.S. Environmental Systems Engineering. 1988. Nanjing University, Nanjing, China
B.S. Engineering. 1985. Tsinghua University, Beijing, China

PROFESSIONAL EXPERIENCE

Senior Scientist, January to July, 2012
Center for Ecological Sciences Tetra Tech, Inc. 1 Park Ave. RTP, NC

Senior Consultant, August to December 2011
Cardno-ENTRIX, Inc. 5400 Glenwood Ave., G-03 Raleigh, NC

Ecological damage assessment of oil spills, water quality modeling and management, ecological data analysis and modeling

Associate Research Professor, June 2004 to August 2011
Nicholas School of the Environment, Duke University, Durham, NC 27708-0328

Teaching:

- Introduction to Environmental and Ecological Data Analysis,
- Applied Regression Analysis,
- Topics in environmental and ecological statistics
- Environmental modeling – A Bayesian perspective

Advising professional and graduate students

Research:

- Environmental and Ecological Statistics –
My research has been focused on the general methodology in the applications of statistics in environmental and ecological studies. The main results are represented in *Environmental and Ecological Statistics with R* published by Chapman and Hall/CRC Press. My guiding principles of data analysis and modeling are largely based on R.A. Fisher's summary of the role of statistical modeling in scientific research. These principles are summarized in Chapter 1 of Qian (2010). I am also an advocate of the theory of multiple working hypotheses of T.C. Chamberline. My significant contributions to the field can be summarized in the following papers:
 1. Qian (1997) first compared several commonly used spatial correlation models and illustrated the difficulty of selecting the correct model and the consequences of using a wrong model. The paper also promoted the use of the Bayesian kriging. This is the only paper in the literature that fully exposed the potential problems of using kriging in analyzing spatial data, especially when the kriging model is used as the basis for subsequent inference.
 2. Qian, King, and Richardson (2003) and Qian, Pan, and King (2004) discussed the potential of using statistical change point models as an analytical method for quantifying ecological thresholds. Although these papers can be greatly improved in many ways, they were the first to systematically illustrate the use of Bayesian change point approach for a threshold estimation problem.
 3. Qian, Stow, and Borsuk (2004) introduced the Bayesian computation method, the Markov chain Monte Carlo (MCMC) method to the ecological modeling community.

4. Qian, Linden, and Donnelly (2005) discussed the problem of reporting estimated microbial counts, instead of raw data. This paper shows that the estimated counts are associated with varying uncertainty, which is ignored in conventional analysis. By using raw data, we can greatly reduce model uncertainty.
 5. Qian, Schulman, and others (2004) developed a Bayesian hierarchical modeling approach for summarizing large cross-sectional water quality monitoring data with a large number of censored values (below method detection limits). The model has been used for the US EPA's Safe Drinking Water Act compliance assessment. I have actively collaborating with colleagues at Chinese Academy of Sciences and Beijing Normal University to apply this model in China. A draft manuscript assessing China's drinking water safety is recently completed.
 6. Qian and Shen (2007) and Qian, et al. (2010) introduced the use of the multilevel model (also known as the Bayesian hierarchical model) to the ecological community. As a result of these papers, a book on multilevel modeling in environmental and ecological studies is contracted by Wiley.
 7. Qian and Cuffney (2011) summarizes my recent research in threshold estimation. This paper illustrates the basic process for identifying a threshold model, parameter estimation, and, most importantly, model evaluation. The paper concludes that the complexity of a threshold problem requires a modeler carefully justify the use a specific model. Empirical evidence separating a threshold response to a continuous response is often unavailable. Only when presenting multiple alternative model, we can justifiably recommend a specific model.
 8. Qian, Cuffney, and McMahon (2011) (Manuscript accepted by JNABS) started the applications of multinomial regression in analyzing species compositional data.
- Water quality model for assessing the effect of TMDL –
I have focused on the use of the USGS' watershed model SPARROW and Bayesian statistics in developing TMDL and in assessing the effects of a TMDL program. This area of work was mostly funded by an EPA STAR grant studying the effect of nitrogen reduction programs implemented in the Neuse River basin. The Bayesian SPARROW model can now be used to model dynamic changes in nutrient loading and a multilevel version of Bayesian SPARROW model is under development for allowing varying model coefficients to account for different nutrient generating mechanisms in different regions of the modeling area.
 1. Qian, Borsuk, and Stow (2001) was the first to show that nitrogen and phosphorus levels in the Neuse River basin have been steadily decreasing from 1980 to 2000 while most in the field still believed the problem of the river and its estuary was eutrophication due to increased nitrogen input.
 2. Qian, et al. (2005) revealed a structural problem in the USGS' SPARROW model and proposed three Bayesian alternatives. Under the current Duke-USGS corporative agreement, I am investigating the feasibility of using the Bayesian SPARROW dynamic modeling of watershed nutrient loading. I am also collaborating with colleagues in China to promote the Bayesian SPARROW as an alternative to many mechanistic models for watershed pollution loading estimation.
 3. Qian and Reckhow (2007) presents a Bayesian updating procedure for assessing the effects of a TMDL program. The guiding principle of this paper is used in the dynamic Bayesian SPARROW for updating changes in nutrient generating processes in a watershed (maybe in response to implementing a TMDL program).
 - Effects of urbanization on stream ecosystems –
I have collaborated with USGS scientists in analyzing the data collected through the NAWQA program with a focus on the effects of urbanization. The collaboration focused on two statistical methods: the Bayesian hierarchical (or multilevel) models and the Bayesian networks models. The multilevel component has resulted in a paper in *Ecology* (Qian et al. 2010), a USGS investigative report, and a book proposal submitted to Wiley. The Bayesian networks component led to one PhD dissertation. In the next year, we will focus on two topics: threshold identification and quantification, and estimating the effects of specific stressors (causal inference using observational data).

- Statistical analysis of climate change data –
My interest in analyzing climate change data is focused on the modeling of phenology data to study the response of plants and animals to climate change. Recently, I have collaborated with colleagues at Duke on how to analyze large cross-sectional data on forest primary production and photosynthesis.

Associate, March 2000 - June 2004

The Cadmus Group, Inc., 6330 Quadrangle Drive, Suite 180, Chapel Hill, NC 27517

Research: Bayesian hierarchical modeling of conventional pollutants and toxic micro-organisms in US drinking water, Modeling fish tissue mercury concentrations in the southeastern US, Ecological risk assessment of pesticides.

Adjunct Assistant Professor, March 2001 - June 2004

Duke University, Nicholas School of the Environment, Durham, NC 27708

Research: Environmental statistics, Bayesian hierarchical modeling for supporting watershed TMDL programs.

Visiting Scientist, September 2000 - December 2000

Water Resources Research Institute of the University of North Carolina, Raleigh, NC 27695-7912

Research: Modeling nutrient loading in the Neuse River Basin using SPARROW

Assistant Professor, January 1997 - May 2000

Environmental Sciences and Resources Program, Portland State University, Portland, OR 97207

Teaching: Environmental Systems; Applied Environmental Studies: Preparation for Problem Solving; Applied Environmental Statistics; Water Resources Management; Topics of Environmental Statistics I: Spatial Statistics in Environmental and Resource Studies; Topics of Environmental Statistics II: Uncertainty Analysis of Water Quality Models; Environmental Science Seminars

Research: Environmental and ecological statistics; Biological index for water quality; Risk assessment; Environmental Decision analysis; Systems identification in water quality modeling; Model structure identification

Advising undergraduate and graduate students

Postdoctoral Research Associate, January - December 1996

Duke University Wetland Center, Box 90333, Durham, NC 27208

Research: Modeling phosphorus retention in the Everglades wetlands

Advising graduate students in the Master of Environmental Management program

Instructor: 1993 and 1996

School of the Environment, Duke University, Durham, NC 27708

Taught *Water Quality Modeling* and *Applied Environmental Statistics*

Research Engineer, 1989 - 1990

South China Research Institute for Environmental Sciences, National Environmental Protection Agency, Guangzhou, China.

Affordable waste-water treatment systems for rural communities in south China.

Lecturer, 1988 to 1989

Department of Environmental Sciences, Nanjing University, Nanjing, China .

Guest Associate Research Fellow, 1987 to 1989.

Research Laboratory of Systems Ecology of Chinese Academy of Science.

International Visitor, 1986 to 1987.

Department of Civil Engineering, Tufts University, Medford, MA

Uncertainty analysis of water quality models

GRANTS AND AWARDS

1. Title: The Development of Modeling Approaches for the National Water Quality Assessment Program Effects of Urbanization on Stream Ecosystems (EUSE) Topical Study
Investigators: S.S. Qian and K.H. Reckhow
Funding Agency: USGS Project Amount: \$ 233,000 (2010-2012)
2. Title: The Development of Modeling Approaches for the National Water Quality Assessment Program Effects of Urbanization on Stream Ecosystems (EUSE) Topical Study,
Investigators: Song S. Qian and K.H. Reckhow
Funding agency: USGS (cooperative agreement)
Project amount: \$ 232,892 (2008-2010)
3. Title: Using Bayesian networks and satellite imagery to implement transparent decision-making and adaptive management
Investigators: Kenneth H. Reckhow, Jon Goodall, Song S. Qian
Funding Agency: EPA ORD's Advanced Monitoring Initiative (AMI)
Project Amount: \$ 250,000 (2007-2009)
4. Title: Understanding Ecological Thresholds in Aquatic Systems Through Retrospective Analysis,
Investigators: C.J. Richardson and S.S. Qian
Funding Agency: EPA STAR Project Amount:\$278,876 (2006-2007)
5. Title: A nonparametric Bayesian approach for quantifying herbicide exposure in streams
Investigators: S.S. Qian and Y. Pan
Funding Agency: EPA STAR
Project Amount: \$167,000 (1999 - 2002)
6. EPA/The Cadmus Group, Inc., Modeling mercury fish tissue concentrations in the southeastern US. \$16,000, summer 1999.
7. Outstanding Teaching Award in Science and Engineering, Portland State University, 2000.
8. Faculty development award, Portland State University, 2000

SOCIETY MEMBERSHIPS

International Association on Water Quality, American Water Resources Association, American Statistical Association, American Association for the Advancement of Science

MANUSCRIPT AND GRANT REVIEWS

BioScience, Canadian Journal of Civil Engineering, Canadian Journal of Fisheries and Aquatic Sciences, Ecological Applications, Ecology, Environmental Engineering Science, Environmental Science and Technology, Hydrological Processes, Journal of Agricultural, Biological, and Environmental Statistics, Journal of American Water Resources Association, Journal of Endangered Species Research, Journal of Environmental Quality, Journal of Environmental Engineering, Journal of Environmental Management, Journal of Great Lakes Research, Journal of Hydrological Engineering, Journal of the North American Benthological Society, Journal of Water Resources Planning and Management, Lake and Reservoir Management, PlosOne, Water Research, Water Resources Research

National Science Foundation

Department of Environmental Quality, State of Oregon

Environmental Services, City of Portland, Oregon

South Florida Water Management District

Maryland Seagrant

Water Resources Research Institute of the University of North Carolina

Corporate Analysis of Marine Ecosystem Organization

Editor, Environmental and Ecological Data Analysis and Modeling, a book series to be published jointly by Wiley and China Higher Education Press