

CURRICULUM VITAE

MARK E. BORSUK

Born March 14, 1973 in Illinois, USA

Married, U.S. Citizenship

EDUCATION

Ph.D. Duke University, Environmental Science and Policy, 2001
M.S. Duke University, Statistics and Decision Sciences, 2001
B.S.E. Princeton University, Civil Engineering and Operations Research, 1995

MAJOR RESEARCH AREAS

Environmental modeling and management, decision theory, Bayesian statistics, uncertainty analysis, risk assessment, valuation methods, imprecise probabilities, sustainability science, expert elicitation

PROFESSIONAL EXPERIENCE

2007 – present Assistant Professor, Department of Engineering Sciences, Thayer School of Engineering, Dartmouth College, New Hampshire, USA
2006 - 2007 Research Assistant Professor, Department of Biological Sciences, Dartmouth College
2004 - 2005 Research Group Leader, Integrated Modeling and Decision Analysis, Department of Systems Analysis, Integrated Assessment and Modeling, Swiss Federal Institute for Environmental Science and Technology (EAWAG), Dübendorf, Switzerland
2001 - 2003 Post-Doctoral Researcher, EAWAG, Dübendorf, Switzerland
1997 Director, Governor's Working Group on Water Quality, Raleigh, North Carolina, USA
1995 - 1996 Engineering Associate, ENVIRON Corporation, Princeton, New Jersey, USA

TEACHING EXPERIENCE

Decision Making under Risk and Uncertainty, Thayer School of Engineering, Dartmouth College, 2007
Integrative River Modeling, PEAK Continuing Education Program, EAWAG, Co-Instructor, 2007
Ecological Modeling, Dartmouth College, Instructor, 2006
Introduction to Decision Analysis, Swiss Federal Institute of Technology (ETH), Co-Instructor, 2002-05
International Water Management Course, EAWAG, Case Study Instructor, 2003
Modeling of Aquatic Systems, PEAK Continuing Education Program, EAWAG, Co-Instructor, 2002-04
Systems Analysis, PEAK Continuing Education Program, EAWAG, Co-Instructor, 2002-04
Preparing Future Faculty Program, Duke University, Participant, 2000-01
Environmental Decision Analysis, Duke University, Co-Instructor, 1998-99
Water Quality Modeling, Duke University, Regular Lecturer, 1998-2000
Water Quality Management, Duke University, Regular Lecturer, 1998-2000
Introductory Statistics, Duke University, Private Tutor, 1996-98

ACADEMIC HONORS

The Universities Council on Water Resources Ph.D. Dissertation Award, 2002
US EPA-STAR Graduate Fellowship, 1999-2001
J.B. Duke Graduate Student Fellowship, 1996-2000
Highest Honors, Princeton University, 1995
Tau Beta Pi Engineering Honor Society, 1995
Phi Beta Kappa Honor Society, 1995
Sigma Xi Research Honor Society, 1995
Princeton University Civil Engineering Department Senior Thesis Research Award, 1995
Times-Mirror Conservation Council Senior Thesis Research Award, 1995
American Water Resources Association Student Award, 1995
Consulting Engineers Council of New Jersey Student Scholarship, 1995
New Jersey Water Pollution Control Association Student Scholarship, 1995

RESEARCH GRANTS

- U.S. Environmental Protection Agency, “Implications of using robust Bayesian analysis to represent diverse sources of uncertainty in integrated assessment,” approximately \$350,000, 2008-2009. Principal investigator.
- U.S. Environmental Protection Agency, “Promoting sustainable pollutant control policies through consideration of social and biological indicators: an application to mercury control in New England,” approximately \$300,000, 2007-2009. Principal investigator.
- U.S. Environmental Protection Agency, “Using Bayesian networks to link river inputs with ecosystem indicators in the Gulf of Maine,” approximately \$250,000, 2007-2008. Principal investigator.
- U.S. Environmental Protection Agency, “Using Bayesian networks and satellite imagery to implement transparent decision-making and adaptive management,” approximately \$250,000, 2007-2008. Co-investigator.
- Rhone-Thur River Restoration Project, Swiss Federal Institute for Environmental Science and Technology, “Integrative modeling in support of river restoration,” approximately \$16,000, 2006-2007. Co-investigator.
- Swiss National Science Foundation, “Estrogenic endocrine disruption in Switzerland: Assessment of fish exposure and modeling of effects at the population level,” approximately \$100,000, 2005-2007. Co-investigator.
- Swiss National Science Foundation, “Decision-theoretic policy assessments using imprecise model predictions,” approximately \$100,000, 2006-2009. Formerly co-principal investigator, currently international collaborator.
- Swiss National Science Foundation, “Implications of imprecision in models for environmental decision analysis,” approximately \$60,000, 2003-2005. Co-principal investigator.
- U.S. Environmental Protection Agency, “Adaptive implementation modeling and monitoring for TMDL refinement,” approximately \$660,000, 2003-2006. Co-investigator.
- U.S. Environmental Protection Agency (STAR) Graduate Fellowship, “A Bayesian Probability Network Approach To Predictive Modeling in Support of Environmental Decision Making,” approximately \$68,000, 1999-2001.

RESEARCH GRANTS (IN REVIEW)

- National Institute of Environmental Health Sciences, NIH, Superfund Basic Research and Training Program, “Toxic Metals in the Northeast: From Biological to Environmental Implications.” Total budget approximately \$2.8 million/year for five years, 2008-2013. Member of Integrative Biology Core and participant in sub-project, “Bioaccumulation and trophic transfer of mercury in aquatic food webs.” In review.
- National Institutes of Health, Centers of Biomedical Research Excellence (COBRE), “Bayesian network modeling of gene-environment interactions and cancer susceptibility,” sub-project of “Quantitative Biology Research Institute (QBRI) for Northern New England.” Sub-project budget approximately \$100,000/year for five years, 2008-2013. Sub-project leader. In review.

JOURNAL PUBLICATIONS

(Student co-authors are underlined.)

- Borsuk, M. E.**, T. A. Larsen, J. Lienert, and M. Maurer. Using decision analysis to chart a path for emerging toilet technology. *Environmental Science & Technology*, in press.
- Mieleitner, J., **M. E. Borsuk**, H.-R. Bürgi, and P. Reichert. Identifying functional groups of phytoplankton using data of three lakes of different trophic state. *Aquatic Sciences*, in press.
- Stow, C. A., K. H. Reckhow, S. S. Qian, E. C. Lamon, G. B. Arhonditsis, **M. E. Borsuk**, and D. Seo. Approaches to evaluate water quality model parameter uncertainty for adaptive TMDL implementation. *Journal of the American Water Resources Association*, **43**: 1499-1507
- Tomassini, L., P. Reichert, R. Knutti, T. F. Stocker, and **M. E. Borsuk**. Robust Bayesian uncertainty analysis of climate system properties using Markov Chain Monte Carlo methods. *Journal of Climate*, **20**: 1239-1254.

- Fenner, K., V. Lanz, M. Scheringer, and **M. E. Borsuk**. Relating atrazine degradation rate in soil to environmental conditions: implications for global fate modeling. *Environmental Science & Technology* **41**: 2840-2846
- Spörri, C., **M. E. Borsuk**, I. Peters, and P. Reichert. 2007. The economic impacts of river rehabilitation: a regional input-output analysis. *Ecological Economics* **62**: 341 – 351.
- Schweizer, S., **M. E. Borsuk**, and P. Reichert. 2007. Predicting the morphological and hydraulic consequences of river rehabilitation. *River Research and Applications* **23**: 303–322
- Schweizer, S., **M. E. Borsuk**, I. Jowett, and P. Reichert. 2007. Predicting joint frequency distributions of depth and velocity for instream habitat assessment. *River Research and Applications* **23**: 287–302.
- Reichert, P., **M. E. Borsuk**, M. Hostmann, S. Schweizer, C. Spörri, K. Tockner and B. Truffer. 2007. Concepts of decision support for river rehabilitation. *Environmental Modelling & Software* **22**: 188-201.
- Rieckermann, J., **M. E. Borsuk**, and W. Gujer. 2006. Using decision analysis to determine optimal experimental design for monitoring sewer exfiltration with tracers. *Water Science & Technology* **54** (6-7): 161-168.
- Borsuk, M. E.**, P. Reichert, A. Peter, E. Schager, and P. Burkhardt-Holm. 2006. Assessing the decline of brown trout (*Salmo trutta*) in Swiss rivers using a Bayesian probability network. *Ecological Modelling* **192**: 224-244.
- Borsuk, M. E.** and L. Tomassini. 2005. Uncertainty, imprecision, and the precautionary principle in climate change assessment. *Water Science & Technology* **52**(6): 213-225.
- Reichert, P. and **M. E. Borsuk**. 2005. Does high forecast uncertainty preclude effective decision support? *Environmental Modelling & Software*. **20**: 991-1001
- Hostmann, M., B. Truffer, P. Reichert and **M. E. Borsuk**. 2005. Stakeholder values in decision support for river rehabilitation. *Archiv für Hydrobiologie (Large Rivers Supplement 15)* **155**: 491-506.
- Rieckermann, J., **M. E. Borsuk**, P. Reichert, W. Gujer. 2005. A novel tracer method for quantifying sewer exfiltration. *Water Resources Research* **41**: W05013, doi:10.1029/2004WR003699.
- Borsuk, M. E.**, C. A. Stow, and K. H. Reckhow. 2004. A Bayesian network of eutrophication models for synthesis, prediction, and uncertainty analysis. *Ecological Modelling* **173**: 219-239.
- Borsuk, M. E.** 2004. Predictive assessment of fish health and fish kills in the Neuse River estuary using the elicited judgment of scientific experts. *Human & Ecological Risk Assessment* **10**: 415-434.
- Borsuk, M. E.**, C. A. Stow, and K. H. Reckhow. 2004. The confounding effect of flow on estuarine response to nitrogen loading. *Journal of Environmental Engineering* **130**: 605-614.
- Borsuk, M. E.**, C. A. Stow, and K. H. Reckhow. 2003. Integrated approach to total maximum daily load development for the Neuse River estuary using a Bayesian probability network model (Neu-BERN). *Journal of Water Resources Planning and Management* **129**: 271-282.
- Stow, C.A., **M. E. Borsuk**, and K. H. Reckhow. 2003. Comparison of estuarine water quality models for total maximum daily load development in the Neuse River Estuary. *Journal of Water Resources Planning and Management* **129**: 307-314.
- Stow, C. A. and **M. E. Borsuk**. 2003. Assessing TMDL effectiveness using flow-adjusted concentrations: A case study of the Neuse River, North Carolina. *Environmental Science & Technology* **37**: 2043-2050.
- Stow, C.A. and **M. E. Borsuk**. 2003. Enhancing causal assessment of estuarine fishkills using graphical models. *Ecosystems* **6**: 11-19.
- Qian, S. S., C. A. Stow, and **M. E. Borsuk**. 2003. On Monte Carlo methods for Bayesian inference. *Ecological Modelling* **159**: 269-277.
- Borsuk, M. E.**, S. P. Powers, and C. H. Peterson. 2002. A survival model of the effects of bottom-water hypoxia on the density of an estuarine clam (*Macoma balthica*). *Canadian Journal of Fisheries and Aquatic Sciences* **59**: 1266-1274.
- Borsuk, M. E.**, C. A. Stow, and K. H. Reckhow. 2002. Predicting the frequency of water quality standard violations: A probabilistic approach for TMDL development. *Environmental Science & Technology* **36**: 2109-2115.
- Stow, C. A., **M. E. Borsuk**, and K. H. Reckhow. 2002. TMDL development in the Neuse River watershed: An imperative for adaptive management. *Water Resources Update* **122**: 16-26.
- Borsuk, M. E.**, C. A. Stow, D. Higdson, and K. H. Reckhow. 2001. A Bayesian hierarchical model to predict benthic oxygen demand from organic matter loading in estuaries and coastal zones. *Ecological Modelling* **143**: 165-181.

- Borsuk, M. E.**, C. A. Stow, R. A. Luettich, Jr., H. W. Paerl, J. L. Pinckney. 2001. Modeling oxygen dynamics in an intermittently stratified estuary: Estimation of process rates using field data. *Estuarine, Coastal and Shelf Science* 52: 33-49.
- Stow, C. A., **M. E. Borsuk**, and D. W. Stanley. 2001. Long-term changes in watershed nutrient inputs and riverine exports in the Neuse River, North Carolina. *Water Research* 35: 1489-1499.
- Borsuk, M. E.**, R. T. Clemen, L. A. Maguire, and K. H. Reckhow. 2001. Stakeholder values and scientific modeling in the Neuse River watershed. *Group Decision and Negotiation* 10: 355-373.
- Qian, S. S., **M. E. Borsuk**, and C. A. Stow. 2000. Seasonal and long-term trend decomposition along a spatial gradient in the Neuse River watershed. *Environmental Science and Technology* 34: 4474-4482.
- Stow, C. A. and **M. E. Borsuk**. 2000. An examination of long-term nutrient data in the Neuse River watershed. *Water Resources Research Institute of the University of North Carolina*. Report No. 325-E.
- Borsuk, M. E.** and C. A. Stow. 2000. Bayesian parameter estimation in a mixed-order model of BOD decay. *Water Research* 34: 1830-1836.

JOURNAL PUBLICATIONS (IN REVIEW OR IN PREPARATION)

- Gronewold, A.D., **M. E. Borsuk**, R. L. Wolpert, K. H. Reckhow. An assessment of fecal indicator bacteria-based water quality standards. Submitted.
- Burkhardt-Holm, P., H. Segner, R. Burki, A. Peter, S. Schubert, M. J. F. Suter, and **M. E. Borsuk**. Estrogenic endocrine disruption in Switzerland: Assessment of fish exposure and effects. Submitted.
- Tomassini, L., P. Reichert, H.-R. Künsch, Ch. Buser, and **M. E. Borsuk**. A smoothing algorithm for estimating stochastic, continuous-time parameters and an application to a simple climate model. Submitted.
- Howarth, R.B. and **M. E. Borsuk**. Discounting the future with uncertain returns on investment. Submitted.
- Schweizer, S., **M. E. Borsuk**, U. Uehlinger, S. Bouletréau and P. Reichert. Predicting the biomass of periphyton and macroinvertebrate functional feeding groups in stream reaches. Submitted.
- Sydlar, D., J. Rieckermann, **M. E. Borsuk**, W. Gujer, P. Reichert. Combining tracer experiments with prior knowledge to optimally diagnose leakage in sewer networks. In preparation. Expected submission date: May 2008.

BOOK CHAPTERS

- Borsuk, M. E.** Ecological models: Statistical methods. A chapter in the *Encyclopedia of Ecology* to be published by Elsevier in 2008.
- Borsuk, M. E.** Ecological Informatics: Bayesian Networks. A chapter in the *Encyclopedia of Ecology* to be published by Elsevier in 2008.
- Borsuk, M. E.** and D. C. Lee. Stochastic population dynamic models as probability networks. A chapter in the *Handbook of Ecological Modelling and Informatics* to be published by WIT in 2007.
- Stow, C. A., **M. E. Borsuk**, and K. H. Reckhow. 2007. Ecosystem risk assessment: The Neuse River Estuary, North Carolina. *Risk Assessment for Environmental Health*. Robson, M. and W. Toscano (eds.), John Wiley & Sons: San Francisco, CA.

CONFERENCE PROCEEDINGS

- Patricia Burkhardt-Holm, Helmut Segner, Richard Burki, Armin Peter, **M.E. Borsuk**. 2005. Endocrine disruption in Switzerland: assessment of fish exposure and effects. *National Research Program 50: Endocrine Disruptors Workshop*, Cadro-Lugano, Switzerland.
- Schweizer, S., P. Reichert, and **M.E. Borsuk**. 2004. Predicting the Hydraulic and Morphological Consequences of River Rehabilitation. *Complexity and Integrated Resources Management*, International Environmental Modelling and Software Society, Osnabrück, Germany.
- Reichert, P., M. Hostmann, S. Schweizer, C. Spörri, **M.E. Borsuk** and B. Truffer. 2004. Concepts of Decision Support for River Rehabilitation. *Complexity and Integrated Resources Management*, International Environmental Modelling and Software Society, Osnabrück, Germany.

- Borsuk, M.E.**, P. Reichert, and P. Burkhardt-Holm. 2004. A Bayesian belief network for modelling brown trout (*Salmo trutta*) populations in Switzerland. *Complexity and Integrated Resources Management*, International Environmental Modelling and Software Society, Osnabrück, Germany.
- Borsuk, M.E.** and L. Tomassini. 2004. Uncertainty, imprecision, and the precautionary principle in climate change assessment. *Uncertainty and Precaution in Environmental Management*, Copenhagen, Denmark.
- Reichert, P. and **M.E. Borsuk**. 2002. Uncertainty in model predictions: Does it preclude effective decision support? In A.E. Rizzoli and A.J. Jakeman (Editors) *Integrated Assessment and Decision Support*, International Environmental Modelling and Software Society, Lugano, Switzerland. Vol. 2, pp. 43-48.
- Borsuk, M.E.**, P. Reichert, and P. Burkhardt-Holm. 2002. A Bayesian network for investigating the decline in fish catch in Switzerland. In A.E. Rizzoli and A.J. Jakeman (Editors) *Integrated Assessment and Decision Support*, International Environmental Modelling and Software Society, Lugano, Switzerland. Vol. 2, pp. 108-113.
- Borsuk, M.E.**, C. A. Stow, and K. H. Reckhow. 2002. Integrative environmental prediction using Bayesian networks: A synthesis of models describing estuarine eutrophication. In A.E. Rizzoli and A.J. Jakeman (Editors) *Integrated Assessment and Decision Support*, International Environmental Modelling and Software Society, Lugano, Switzerland. Vol. 2, pp. 102-107.
- Borsuk, M.E.**, C. A. Stow, and K. H. Reckhow. 2001. A probability network model for TMDL development in the Neuse River watershed. In J. J. Warwick (Editor) *AWRA Annual Spring Specialty Conference Proceedings*, American Water Resources Association, Middleburg, Virginia. pp. 127-131.

STUDENT SUPERVISION

- Apurva Nair, Ph.D. dissertation, “Evidence-based evaluation of environmental policies” Dartmouth College, Anticipated completion date: Spring 2011.
- Ashley Hetrick, Senior Thesis, “Modeling methylmercury trophic transfer and bioaccumulation in estuarine food webs,” Dartmouth, 2006-07.
- Alina Plavsky, Women in Science Project, “Predictive modeling in the environmental sciences,” Dartmouth, Winter/Spring 2007.
- Lorenzo Tomassini, Ph.D. dissertation, “Implications of imprecision in models for environmental decision analysis” EAWAG-ETH. Primary advisor. Planned completion 2007.
- Steffen Schweizer, Ph.D. dissertation, “Integrative probability network model for predicting the consequences of river revitalization” EAWAG-ETH. Co-advisor. Completed 2006.
- Johanna Mieleitner, Ph.D. dissertation, “Choice of plankton model aggregation level” EAWAG-ETH. Co-advisor. Completed 2006.
- Annina Mürner, Master’s thesis, “Practical application of a fish population model” EAWAG-ETH. Co-advisor. Completed 2005.
- Valentin Lanz, Master’s thesis, “Statistical analysis of atrazine degradation rates in soil and application to a global distribution model” EAWAG-ETH. Co-advisor. Completed 2005.
- Dominic Sydler, Master’s thesis, “Using prior knowledge and tracer measurements to optimally diagnose wastewater loss in sewer networks” EAWAG-ETH. Co-advisor. Completed 2005.

OTHER PROFESSIONAL ACTIVITIES

Editorial Board: *Operations Research, Environmental Modelling & Software*

Reviewer: *Ecosystems, Estuarine, Coastal and Shelf Science, Limnology & Oceanography, Freshwater Biology, Environmental Science & Technology, Water Resources Research, Water Research, Ecological Modelling, Environmental Management, Journal of Environmental Engineering, Estuaries, Decision Analysis, Risk Analysis, Journal of the American Water Resources Association*

CONTACT INFORMATION

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SUGGESTED REFERENCES

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Swiss Federal Institute for Environmental Science and Technology (EAWAG)
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