

## Water Resources Center

UNIVERSITY OF MINNESOTA

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March 2009

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*The Water Resources Center is affiliated with the College of Food, Agricultural and Natural Resource Sciences and University of Minnesota Extension.*

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## WRC researcher awarded grant to adapt new shoreline BMPs to climate change

Barbara Liukkonen (WRC Education Coordinator) and fellow research partners, John Chapman and Bruce Wilson (BBE), Camilla Correl (Emmons & Olivier Resources), Miki Hondzo and Anne Lightbody (SAFL), Mary Blickenderfer, Shane Missaghi and Karen Terry (UM Extension), were awarded full funding of a \$208,700 319 grant proposal to the Minnesota Pollution Control Agency (MPCA). The MPCA received 17 applications requesting nearly \$3 million and awarded \$1 million in grants. The project, Adapting Minnesota Shoreland BMPs for Climate Change, will investigate guidelines adapting shoreline best management practices (BMPs) to potential effects of climate change.

The possible effects of climate change have not been taken into consideration in current shoreland bioengineering practices. Even recently installed shoreland BMPs designed to protect water quality may need to be adjusted. This 319 project also addresses the effect of variable water levels on the success or failure of shoreland BMPs.

The project has three major components: leadership for a statewide Climate Change Adaptation Working Group; coupled hydrodynamic lake modeling; and field experimentation. The Climate Change Adaptation Working Group formed in June 2008 and will meet monthly to identify needs,

*319 Grant Award continued on page 7*

## EPA chief scientist emphasizes environmental priorities



Dr. Pai-Yei Whung and WRC co-director Dr. Deborah Swackhamer.

Promoting risk management over crisis management as a smarter use of resources, Dr. Pai-Yei Whung highlighted the Obama administration's environmental strategy during her presentation on the St. Paul Campus. Climate and energy, environmental contaminants, homeland security and emergency response, and modernization of infrastructure are EPA priorities as established by the Science Policy Council in 2008. Dr. Whung emphasized the EPA's integrated science-based approach to policy-making and confirmed President Obama's admonition that politics should not trump hard scientific facts. Science must be the backbone for EPA policies, the EPA will follow the rule of law, and its actions must be transparent. Dr. Whung was in Minnesota to meet with WRC co-director Deb Swackhamer, chair of the EPA's Science Advisory Board.

## WRC awards three grants in 2009 competition

The Water Resources Center selected three research projects for funding in 2009. The projects study perfluorochemicals in urban stormwater, degradation of pesticides and resulting contamination of groundwater, and mercury entering the water system through leaf litter.

### Urban stormwater inputs of perfluorochemicals

Perfluorochemicals (PFCs) are used in many industrial polymers and commercial products from Teflon<sup>TM</sup> to Scotchgard<sup>TM</sup>. Despite the phase-out of these chemicals from production,

they are widespread in the environment and continue to cause environmental and human health concerns. In 2007, several Twin Cities metropolitan lakes were labeled impaired for contamination with a suite of perfluorochemicals, primarily perfluorooctane sulfonate (PFOS) in fish. While Minnesota is home to 3M Corporation, which produced and disposed of many of these chemicals, many of the lakes listed as impaired have no connection to 3M's production or disposal. Because many PFCs were used in commercial products, wastewater is another potential source to surface waters, although none of these lakes

*WRC Grants continued on page 2*



February ended with prospective graduate students spending time on the St. Paul and Duluth campuses learning about the Water Resources Science (WRS) program. Prospective students met with faculty who share their research interests, attended formal meetings on the program's features and requirements, and spent time with current WRS students to hear about life in the program from the students' perspective. It was a time of excitement and high energy. One young woman told me that she has applied to three graduate programs across the country, but that the WRS program is her first choice because it is broad and deep and has a sound track record.

Her comment made me reflect on what makes this program so special, and I have to conclude that its success is multi-faceted. The young woman I spoke to mentioned that our program was one of the earliest graduate programs to focus on water resources. Thanks to the foresight of several faculty over ten years ago, we have a robust graduate program that is training our future professors, researchers, policy makers and practitioners. The WRS program is an interdisciplinary program that draws from two campuses and multiple colleges. The faculty is well respected and represents the breadth of disciplines that touch water resources. Students are exposed to local, state and national experts, such as Dr. Pai-Yei Whung, the chief scientist at the US Environmental Protection Agency, who visited the Water Resources Center in January. That same day, students had the opportunity to hear from an official from the US Department of Agriculture.

Many of you water resources partners in the public and private spheres are also responsible for helping to make this graduate program attractive to many top-notch students. Directly and indirectly, you provide opportunities for students to engage in and research water chemistry, policy, hydrology, new technologies for urban and rural settings, and many other types of work. Those of you who come to lecture, or invite students to learn more about water resources in your sector, add to the rich experience of our students. Many times when I am at off-campus meetings, I am aware that various initiatives being discussed include research by WRS students and faculty. The fact the Minnesota has a strong reputation in managing its water resources increases students' desire to come to Minnesota to study.

So as students consider applying to the WRS program, they clearly take into account the high quality of faculty and research facilities. They also know they are coming to a program strengthened by sound partnerships in the greater Minnesota water resources community.

Faye Sleeper  
WRC co-director

receives direct wastewater discharge. PIs Matt Simcik (Environmental Health Sciences) and John Gulliver (Civil Engineering) hypothesize that a significant source of PFCs to surface waters is urban stormwater, which receives PFCs from commercial, industrial and residential sources within the watershed. They propose to sample temporal composites of urban stormwater integrated over storm events and analyze the samples for a suite of PFCs. These PFC concentrations will be combined with detailed land-use information for the watershed to model the source apportionment of PFCs to urban stormwater. Objectives of this study are to quantify the magnitude of PFCs loading from urban stormwater, to identify unique land-use characteristics that lead to PFC contamination, and to determine the efficacy of suspended sediment removal as a technique for removing PFCs from stormwater.

#### **Reductive degradation of pesticides: Solid-state and solution-phase dynamics**

Groundwater is contaminated by many human activities, including intentional and accidental releases of pesticides and leaching of pesticides from sites of application into subsurface soils. Many pesticides are amenable to degradation by way of abiotic reductive degradation, and many degradation reactions occur at the mineral-water interface. William Arnold (Civil Engineering) and Lee Penn (Chemistry) propose to quantify the changes in mineralogy of sediment samples caused by reductive transformation of selected pesticides and quantitatively link these solid-state changes to the evolving kinetics of contaminant degradation. They hypothesize that natural sediments under reducing conditions continuously exposed to oxidized contaminants develop a pseudo-steady-state reactivity. The study uses a combination of batch and column experiments in which the kinetics of pesticide reduction are quantified and changes in mineralogy are also quantified using a variety of solid-state characterization techniques. Quantifying pseudo-steady-state reactivity will determine potential for long-term contaminant attenuation.

#### **Fate and bioavailability of litter mercury in Minnesota streams and rivers**

Mercury (Hg) contamination is found in many aquatic habitats worldwide. Conversion of inorganic Hg to monomethylmercury (MeHg) represents the most important process in regulating the bioavailability of Hg and subsequent Hg concentrations found in top predators within food webs. The majority of previous research on environmental regulation of Hg bioavailability focused on the methylation of Hg in sediments. New evidence shows that non-sedimentary compartments, such as periphyton and leaf litter, function as important sites for MeHg production in aquatic ecosystems. Leaf litter from riparian zones may play an important role in stream Hg dynamics because leaf litter is a primary source of energy and nutrients to river food webs in the temperate region. Litter is also an important source of Hg derived from the atmosphere during the growing phase. Hg deposits on leaves during the growing season, and then leaf litter delivers Hg to the forest floor. PIs Jacques Finlay (Ecology Evolution and Behavior) and Edward Nater (Soil, Water, and Climate) recently demonstrated that stream water chemistry and litter species can influence Hg release and subsequent methylation of Hg in litter in laboratory incubation experiments. These results suggest that water quality variation as well as riparian tree species within and among streams and rivers may influence the

*Continued on page 3*

# Groundwater sustainability workshop evaluates Minnesota water supply

The Water Resources Center and the Freshwater Society hosted a groundwater workshop at the St. Paul Student Center November 12, 2008, with nearly 70 water scientists and water managers in attendance. Workshop organizers hoped to answer the question: what do we know, and what don't we know, about how to manage Minnesota's groundwater sustainability for the future? The workshop steering group invited a range of technical experts from around the state, as well as outside speak-



Freshwater Society President Gene Merriam welcomes attendees to the groundwater conference.

ers, to work through the data gaps and modeling approaches needed to advance the understanding of groundwater resources in Minnesota. The workshop included presentations by Bruce Wilson, UM professor in the Department of Bioproducts and Biosystems Engineering, who detailed the hydrological cycle and summarized water use by category in Minnesota. Barr Engineering hydrologist Ray Wuolo, who developed a computer model that predicts the effect of increasing population on ground and surface water use, elaborated on water

## *WRC Grants, continued from page 2*

cycling of litter Hg, especially during the autumn litterfall period. Current field evidence on Hg cycling via decomposing litter in streams and rivers is limited. Nater and Finlay intend to examine how watershed land cover affects stream water chemistry and also how plant species composition influences litter decomposition and associated Hg release and methylation in streams and rivers.

use in the metro area. Wuolo described measuring regional storage parameters to monitor water depletion, using models proactively rather than reactively, and "growing" models rather than continually reinventing them. Howard Reeves, an hydrologist from the United States Geological Survey (USGS), spoke to Michigan's experience using a stakeholder group, the State Legislative Water Advisory Council, to pass new water laws. Kenneth Bradbury, research hydrologist for the Wisconsin Geological and Natural History Survey, talked about the consequences of groundwater use and efforts in Wisconsin to measure the effects of a 2003 law that enhanced the state's authority to regulate groundwater quantity. Nebraska hydrologist Virginia McGuire (USGS) gave an assessment of the Ogallala Aquifer and discussed maintaining the flow in the Platte River through regulating groundwater use for irrigation. Workshop participants developed a list of research and data needs, as well as ideas for future workshops. The workshop was planned by a steering committee with representatives from the University of Minnesota, the Freshwater Society, Minnesota Department of Natural Resources, Metropolitan Council, Minnesota Department of Health, Minnesota Geological Survey, US Geological Survey, Minnesota Ground Water Association, and the Environmental Quality Board.

To view the speaker presentations visit:  
<http://www.freshwater.org/>

The WRC receives funding from the United States Geological Survey (USGS) to award as seed money to university faculty working on water projects in the state. Faculty submit proposals which are evaluated by external reviewers. Funding decisions are made by a committee composed of WRC co-directors, USGS scientists, state agency scientists and faculty.

## Legislative Update

### Ominous budgets and a hopeful future

Governor Tim Pawlenty's proposed budget for fiscal year 2010–2011 demonstrates that the economic downturn will affect just about everyone. Based on his proposed \$151 million recurring cut to the University of Minnesota's biennial budget, the university could expect a reduction in state funding of anywhere between five and eight percent.

Also unknown is how the Minnesota State Legislature will implement the Clean Water, Land and Legacy Amendment passed in November—in particular, how it will distribute the incoming funds. The amendment will collect an additional three eighths of one percent sales tax and distribute the revenue four ways: one third to a Clean Water Fund, one third to an Outdoor Heritage Fund for habitat and wildlife preservation, and one third to be split between a Parks and Trails Fund and an Arts and Cultural Preservation Fund.

Rep. Mary Murphy (DFL-Hermantown) was named the chair of the House of Representative's Culture and Outdoor Resources Finance Committee established to oversee the amendment's investments. The Senate's Environment, Energy and Natural Resources Budget Division and its chair, Sen. Ellen Anderson (DFL-St. Paul), have established subcommittees specific to three of the amendment's four distinct areas—outdoor heritage, clean water, and parks and trails—to do the same.

The Senate's Clean Water Subcommittee, chaired by Sen. Sandy Rummel (DFL-White Bear Lake), recently heard testimony from the Clean Water Council on its recommendation to use \$172 million of the water money to address impaired waters around the state. The Clean Water Council was created in 2006 to oversee the Clean Water Legacy Fund. Its role relative to the amendment-created Clean Water Fund and the Clean Water Subcommittee is yet to be sorted out.

Estimates that the amendment would raise \$300 million per year have been revised downwards due to the recession. Whatever the annual amount, the revenues will give water managers and advocates a substantial foothold in the fight to protect, preserve and restore Minnesota's waters.

Photo: Valérie Wère

## WRS Professor's *E. coli* fingerprinting methods close in on human sources

One of the world's foremost experts on tracking the sources of *E. coli*, Michael Sadowsky may also be responsible for keeping the fun in our short-lived Minnesota summers.

Through grants from the Water Resources Center, Minnesota Sea Grant, and the Minnesota Department of Agriculture, Sadowsky, a professor in the University of Minnesota's Department of Soil, Water, and Climate and the BioTechnology Institute and member of the Water Resources Sciences (WRS) graduate faculty, has found a way to tease out stretches of marker DNA that indicate whether the bacteria taken from lakes or streams came from human or nonhuman sources.

The distinction is important—public beaches are routinely shut down when fecal bacteria counts are high. But bacterial counts from nonhuman sources don't necessarily merit the same response or treatment.

“Current methodologies used by regulatory

agencies only determine if fecal bacteria are contaminating waterways, not where the bacteria come from,” says Sadowsky, recently named a fellow of the American Association for the Advancement of Science. “The assumption is that elevated fecal counts come from human sewage, and thus there is a health risk. Our data and those of others have shown that there are many potential input sources of *E. coli* in waterways and that, in many instances, wild animals, soils, and even algae can contribute to elevated fecal counts.”

Sadowsky and his colleagues have created libraries of DNA fingerprints from *E. coli* obtained from 17 different animal hosts, ranging from beaver to human, and isolated marker genes unique to *E. coli* from different animal sources. With a completed library, they aim to take *E. coli* samples found at beaches and match them to host-specific strains in the *E. coli* fingerprint library.

They also developed a genome robot to sample bacterial colonies as part of a system that promises to provide municipalities a

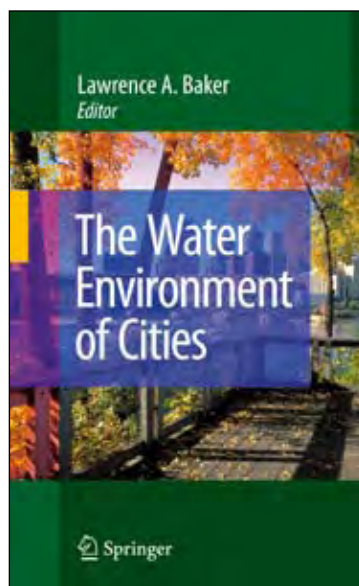
cost-effective, quantitative and accurate way to determine the sources of bacteria in public waters—as well as a better way to assess health risks and design effective clean-up strategies.



Professor Michael Sadowsky's research looks for the sources of *E. coli* in lakes and streams.

## WRC Senior Fellow Larry Baker publishes book assessing urban water environments past and future

Overflowing cesspools spreading cholera and typhoid, the Cuyahoga River polluted so badly that it literally caught on fire—these are just two of the catastrophic outcomes of early trial-by-error urban water systems chronicled in the new book: *The Water Environment of Cities*, edited by WRC Senior Fellow Larry Baker. Baker closely coordinated chapters with leading water experts around the U.S. to develop a holistic vision of the urban water environment. Core chapters address urban water budgets, groundwater management, urban water infrastructure, management of urban streams, the legal framework of



water management institutions, integration of water into planning design, and the economics of water supply. Although Baker designed the book to be accessible to a broad, multidisciplinary audience, topics were chosen for a core audience of engineers, city planners, ecologists, hydrologists, and social scientists. Each chapter considers six themes: water scarcity, multiple uses of water, water management institutions, integration of new knowledge, sustainability and resilience.

The Earth's urban population is projected to reach five billion by 2030. The book asserts that managing water for the burgeoning urban population will be critical to the well-being of the planet and of humanity.

“Humans have altered the urban hydrological cycle and the chemical and physical integrity of urban water systems and resources,” says Baker. “Some of those changes are beneficial, and others are harmful. Understanding those changes and impacts requires expertise and perspective from a wide range of disciplines. I've sought out chapter authors who represent this broad diversity of expertise.”

Authors gathered at a synthesis workshop to write the final chapter: Blueprint for the Future of the Urban Water Environment. *The Water Environment of Cities* is available at: <http://www.springer.com>

## Distinguished Visitor Program builds bridges for water students

As part of University of Minnesota's largest interdisciplinary graduate program, Water Resources Science (WRS) students hail from more than twelve academic units across the University's Twin Cities and Duluth campuses. The breadth of the program's student base—ranging from civil engineering to forest resources to economics—is testament to water science's popularity. But popularity also presents a challenge in terms of community building for nearly 80 students across two campuses.

"Creating and maintaining WRS student and faculty identity and interaction has been a challenge with the many other competing departmental, collegiate and university time demands," said Ray Newman, director of the WRS graduate studies program. "We are looking to build a program that is

academically rewarding, as well as to foster community among students and faculty on both campuses."

Last spring, with a \$10,000 grant from the University's Graduate School, WRS kicked off its Distinguished Visitor Program, an initiative designed to bring its students and faculty together in a series of engaging lectures, workshops, poster sessions and retreats built around a nationally recognized speaker. Speakers were selected for their broad appeal and were scheduled for multiple appearances on both Twin Cities and Duluth campuses.

In April, the program hosted three days of lectures and information sessions with Michael Pace, professor of environmental science at the University of Virginia,

and John Downing, professor of ecology, evolution and organismal biology at Iowa State University. This past fall, the program sponsored two days of events with Jörg Imberger, director of the Centre for Water Research at the University of Western Australia.

"Interaction among WRS graduate students and faculty can be challenging due to diverse research interests and the non-centralized nature of our program," said WRS student Jessica Eichmiller, who also served on the program's steering committee. "But the Distinguished Visitor Program had broad enough appeal to attract the involvement of WRS students system-wide. It was a terrific, life-changing opportunity to see how our work comes together on a common theme."

## Wetlands conference analyzes Minnesota's wetland policies

Discussion of proper care of Minnesota's wetlands requires the meeting of many disciplines and minds. On January 21, the second Annual Minnesota Wetlands Conference hosted nearly 240 attendees on the St. Paul Campus. Participants learned about wetland mitigation and discussed whether Minnesota is reducing the loss of wetlands throughout the state and in the Midwest. The event was hosted by the Minnesota Wetland Delineator Certification Program (WDCP) and the Minnesota Wetland Professionals Association (WPA). Speakers included Karli Swenson and Carol Strojny from the Board of Water and Soil Resources (BWSR); Joe Schaffer from Minnesota Native Landscaping; Sarah Stai from Westwood Professionals Association; Dr. Susan Galatowitsch from UM -Twin Cities;

Dr. Joy Zedler from UW-Madison; Dr. Chev Kellogg from the Minnesota Department of Natural Resources (MDNR); and Ryan Boe and Linda Fischer from the law office of Larkin, Hoffman, Daly, & Lindgren, Ltd. The speakers offered varied perspectives of complex wetland mitigations. Themes discussed were: the status of the Wetland Bank Program in Minnesota, the most common problems across the state, a contractor's role in mitigation, buffers, reed canary grass, concepts of wetland functions, and liabilities and permits.

Vendors from around Minnesota set up booths and provided information, resources, and tools for successful wetland delineations and mitigation. The WPA honored recently retired Greg Larson (BWSR) with their annual leadership award. Les Lemm, BWSR; Mark Gernes, Minnesota Pollution Control Agency; Doug Norris, MDNR; and Steve Eggers, US Army Corps of Engineers; summarized the main points and answered conference goers' questions in a wrap-up of the conference.



Elizabeth Wells, conference coordinator, with WPA president Rich Davis and moderator Mark Perry of Bolton and Menk, Inc.

Elizabeth Wells, WRC/SWC program specialist and one of the conference coordinators, was pleased with the outcome. "This year we had more speakers, and we varied the time intervals for each, keeping things energized and offering a variety of points of view. Our speakers and conference attendees ranged from contractors and consultants to government employees, educators, students, and legal advisors. I think this was a great opportunity for our attendees to network and discover ideologies outside their own work environments."



Conference attendees listen to a presentation.

# Community News

**Dr. Melinda Erickson** (WRS graduate faculty and WRS graduate) accepted a position at the United States Geological Survey as Groundwater Specialist. She is employed by the Minnesota Pollution Control Agency, and is also an adjunct assistant professor in UM Bioproducts and Biosystems Engineering.

**Karen Gran** (WRS graduate faculty, UMD Geological Sciences) received a grant from the National Science Foundation entitled “Decadal-scale channel evolution at Mount Pinatubo, Philippines,” to continue research at Mount Pinatubo following its 1991 eruption.

**Robert Hecky** (WRS graduate faculty, UMD Biology) and colleagues recently published “Eutrophication of lakes cannot be controlled by reducing nitrogen input: Results of a 37-year whole-ecosystem experiment” in *Proceedings of the National Academy of Sciences* (PNAS). *Discover* magazine named the paper as one of the top 100 science stories of 2008.

**Randall Hicks** (WRS graduate faculty UMD, Biology), Mike Sadowsky (WRS graduate faculty, Soil, Water, and Climate), Dennis Hansen and Satoshi Ishii will publish a research article “*Escherichia coli* Populations in Great Lakes Waterfowl Exhibit Spatial Stability and Temporal Shifting,” in the March 2009 issue of *Applied and Environmental Microbiology*.

The president of the International Association of Great Lakes Research (IAGLER) announced that Duluth, MN, has been selected as the site of the 54th Annual Conference in May 2011. This will be the first time the IAGLR annual conference will be held in Minnesota or on the shores of Lake Superior. **Randall Hicks** (WRS graduate faculty UMD, Biology) director of the UMD Center for Freshwater Research and Policy, credits the Center, university and local agency partners, including Minnesota Sea Grant, MPCA, and Minnesota DNR for developing the successful proposal.

**Mike Sadowsky** (WRS graduate faculty, Soil, Water, and Climate) was named a 2009 fellow by the American Association for the Advancement of Science (AAAS). Sadowsky was honored for his contributions to the field of environmental microbiology, including his work in molecular plant-microbe interactions, biodegradation of chlorinated herbicides and finding sources of fecal bacteria.

**Sangwon Suh** (WRS graduate faculty, Biosystems and Bioproducts Engineering) has been named a 2009–2011 McKnight Land-Grant Professor at the University of Minnesota. The program is designed to advance the careers of promising junior faculty at a critical point in their professional lives.

**For the latest in WRC news and events visit: <http://wrc.umn.edu/>**

## Student News

**Christine Dolph** (WRS) presented “Development of a Multivariate Predictive Model for Assessing the Quality of Streams in Minnesota,” at the Midwest Fish and Wildlife Conference in Columbus, OH, December 14–17, 2008.

**Rebecca Forman** received her Ph.D. in January 2009. Her thesis was: “Habitat Selection and Ecological Stoichiometry: The Role of Seston C:P in *Daphnia* Daytime Spatial Location.” Forman was advised by **Raymond Newman**.

**Katherine Huser** received her M.S. in December 2008. Her thesis was: “Using High-resolution Satellite Imagery for Aquatic Vegetation Surveys.” Huser was advised by **Patrick Brezonik**.

**Amanda Janet** received her M.S. in December 2008. Her thesis was: “Wood Creek Channel Enlargement and Total Phosphorus Export to Medicine Lake, Plymouth, MN.” Janet was advised by **John Nieber**.

**Jeremy Kulesa** received his M.S. in January 2009. His thesis was: “Influence of Changing Climate on Flows in the Minnesota River at Mankato, Minnesota.” Kulesa was advised by **David Mulla** and will be continuing as a WRS Ph.D. student.

**Bridget Seegers** (WRS) presented “The Lake Superior Deep Chlorophyll Maximum Related to Zooplankton Grazing,” at the American Society of Limnology and Oceanography, in Nice, France, January 25–30, 2009.

**Brandon Stephens** received his M.S. in December 2008. His thesis was: “DOM Characteristics along the Continuum from River to Reservoir: a Comparison of Freshwater and Saline Transects.” Stephens was advised by **Elizabeth Minor**.

**Brian Tolcser** received his Wetland Delineation certification in February 2009. Brian is also part of a research group headed by **Joe Knight** (Forest Resources) that received funding from LCCMR to

do methods development research for the update of the Minnesota National Wetlands Inventory.

**Haibo Wan** received his Ph.D. in December 2008. His thesis was: “Development and Evaluation of Methodologies for the Classification of Ecological Communities.” Wan’s co-advisors were **Jim Perry** and **Bruce Wilson**.

**Jill Coleman Wasik** received her M.S. in November 2008. Her thesis was: “Chronic Effects of Atmospheric Sulfate Deposition on Mercury Methylation in a Boreal Wetland: Replication of a Global Experiment.” Coleman Wasik was advised by **Dan Engstrom**.

**Jill Coleman Wasik** (WRS) presented “Hydrologic Fluctuations Resulting from Climatic Variability Cause Methylation Events in Peatlands Impacted by Elevated Sulfate Deposition,” at the American Geophysical Union Fall Meeting in San Francisco, CA, December 15–19, 2008.

*319 Grant Award, continued from page 1*

share results, and improve inter-agency communication regarding the need for management practices and policies adaptable to conditions resulting from climate change.

The Working Group will identify three climate change scenarios for Minnehaha and Brown's Creeks to be used in XPSWMM modeling, which simulates the complete hydrologic cycle. The stream flow and nutrient loading data generated from the XPSWMM watershed modeling will be incorporated as input into a three-dimensional lake model and applied to Lake Minnetonka allowing examination of spatial and temporal changes in water quality that will include fluctuating water levels, temperature, dissolved oxygen, nitrogen, and phosphorus. The simulation will evaluate various climate change scenarios on vegetated habitats and water quality and will also be used to help design an experimental field system.

The field experiment component of the project will be conducted at the Outdoor Stream Lab (OSL) at the St. Anthony Falls Lab (SAFL). The riverine corridor and multiple experimental plots will be established

and monitored to study their response to various climate change hydromodifications and rain events. Plant survivability and sediment nutrient release will be monitored.

Shoreline bioengineering practices will be assessed for their survivability in a changing climate and water level regime. Ultimately, the project will provide design guidelines for bioengineering practices adapted for potential climate change scenarios. Recommendations and results will be disseminated to practitioners such as local units of government and consulting firms engaged in designing, funding, and installing shoreland BMPs.

The project was approved for funding in December 2008; funds are likely available in fall 2009. Modeling will begin as grant funds are received, and field experimentation installed and monitored during 2010. Data analysis and development of recommendations will occur during late 2010 and 2011.

## *Minnegram*

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**Editors:** Christine Hansen, Tracy Thomas Wilson

**Submissions:** *Minnegram* welcomes articles, letters to the editor, community news, news stories, photos, and other materials for publications.

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## *Upcoming Events*

*April 16, 2009*

### **10th Annual Protecting the St. Croix Conference**

*UW River Falls, WI, The University Center.*

WRC co-director Deb Swackhamer will present at the conference. For more information, visit: <http://basineducation.uwex.edu/stcroix>

*May 18–22, 2009*

### **52nd Annual Conference on Great Lakes Research, Bridging Ecosystems and Environmental Health across our Great Lakes**

*University of Toledo, Toledo, Ohio.*

For more information, visit <http://www.iaglr.org/conference/>

*June 1–4, 2009*

### **International Symposium on Genetic Biocontrol of Invasive Fish**

*Doubletree Hotel, Minneapolis, MN.*

This symposium is designed for international scientists specializing in fish genetics, biotechnology, risk assessment science and ecology and professionals who work to manage invasive fish. Visit: <http://sea-grant.umn.edu/ais/biocontrol> for more information

*October 26–27, 2009*

### **Minnesota Water Resources Conference**

*RiverCentre, Saint Paul, MN.*

This conference presents innovative and practical water resource management techniques and highlights research about Minnesota's water resources, including: best practices in design and application of water resource management techniques, implications of water policy decisions, and research into current and emerging water issues.

**Abstracts are due by Friday, March 27, 2009 and must be submitted electronically to:**  
<http://wrc.umn.edu>

# Publications & Resources

## *Fate and Effects of Alkylphenols and other Endocrine Active Chemicals in Three Minnesota Streams*

Lee, K.E., Schoenfuss, H.L., Jahns, N.D., Brown, G.K., and Barber, L.B., 2008, Alkylphenols, other endocrine-active chemicals, and fish responses in three streams in Minnesota—Study design and data, February–September 2007: U.S. Geological Survey Data Series 405, 44 p. plus appendixes. <http://pubs.usgs.gov/ds/405/>

The UMD Center for Freshwater Research and Policy (CFRP) recently published “Fresh Water: Understanding and solving freshwater problems facing the world.” Copies of this publication can be downloaded from the CFRP web site: [http://www.d.umn.edu/cfrp/documents/cfrp\\_aq.pdf](http://www.d.umn.edu/cfrp/documents/cfrp_aq.pdf)

The MN DNR’s “Healthy Rivers: A Water Course” is now available online at <http://www.dnr.state.mn.us/healthyrivers>. The original CD-ROM product was released in 2004 and now has out-dated links and references, but the online content

has been corrected and is current. Requests for a free Healthy Rivers CD-ROM can be made to: Amy Childers, MnDNR Division of Ecological Resources Stream Habitat Program at 218.739.7576 x 233 or [amy.childers@dnr.state.mn.us](mailto:amy.childers@dnr.state.mn.us). The program can be copied from the CD-ROM onto school and personal computers. We will be adding complimentary materials (such as stream table designs and activities, classroom and field activities, stewardship and monitoring opportunities) to the website as they develop. Please contact Childers with any questions.

Gerald Niemi (NRRI and UMD Biology), Lucinda Johnson (NRRI, UMD), and Valerie Brady (NRRI, MN Sea Grant, UMD) are three of eight co-authors of the International Joint Commission’s white paper “Ecosystem-Responses to Regulation-based Water Level Changes in the Upper Great Lakes. A digital copy of the paper may be obtained from [mbell@nrri.umn.edu](mailto:mbell@nrri.umn.edu)

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