

## Water Resources Center

UNIVERSITY OF MINNESOTA

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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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## 2009 Minnesota Water Resources Conference explores issues of water quantity and quality

Climate change, disappearing wetlands, and renewed calls for clean water as a national priority were lively topics at the 2009 Minnesota Water Resources Conference October 26 and 27 at the RiverCentre in St. Paul, MN. While the Mississippi River flowed nearby, 670 water professionals, resources managers, educators and students gathered to hear guest speakers at two plenary sessions as well as two luncheon presentations. The conference offered four concurrent sessions each day on a wide variety of water-related topics ranging from lake management to agriculture to stormwater. UM faculty and students as well as state agency staff and consultants displayed 31 posters throughout the conference.

The conference is sponsored by the Water Resources Center and the College of Continuing Education, and co-sponsored by the Department of Civil Engineering, the Minnesota Section of the American Society of Civil Engineers, Minnesota Sea Grant, and the Natural Resources Research Institute.

The conference opened with Ed Nater, head of the Department of Soil, Water, and Climate presenting the Dave Ford Water Resources Award to former WRC co-director James Anderson. The award recognized Anderson's contributions to Minnesota's waters, which included his role as the director of the Individual Septic Treatment Systems program in UM Extension, coor-



James Anderson holds the Dave Ford Award plaque after receiving it at the Water Conference. Pictured with Anderson are WRC co-director Faye Sleeper, department head Ed Nater (Soil, Water, and Climate), and WRC co-director Deb Swackhamer.

Photo credit: Ryan Rodgers

dinating work with state and federal agencies within Minnesota, and service on the boards of the MPCA and BWSR. Nater quoted a colleague's remarks about Anderson, "Jim, your leadership has led to funding for major research and extension projects resulting in better management of fertilizers, pesticides, manure wastewater, tillage, grazing, wetlands, and other areas. The relationships and networks that you built will continue to contribute to natural resource protection long after your retirement date."

Jerry Schnoor of the University of Iowa, who is the Allen S. Henry Chair in Engineering and co-director of the Center for Global and Regional Environmental Research, presented Monday's plenary session, "Living with a Changing Water Environment." He listed the drivers of water resources and climate change

*Water Conference, continued on page 2*



WRC co-director Deb Swackhamer and Congresswoman Betty McCollum prior to Ms. McCollum's luncheon speech.

Photo credit: Ryan Rodgers



This past October, we sponsored the annual Minnesota Water Resources Conference with a near record attendance of 670 water scientists, professionals, managers, and engineers (see front page story). We were pleased to have Professor Jerry Schnoor from the Department of Civil Engineering at the University of Iowa, Congresswoman Betty McCollum, USGS water chemist Paul Capel, and USFWS wetland specialist Rex Johnson deliver plenary presentations. The conference filled two days with four concurrent sessions. This successful format is in its fourth year, and due to the growth in attendance, we now hold it at RiverCentre, downtown Saint Paul.

Looking ahead, we are about to ring in the new year of 2010. The first decade of the 21st century is drawing to a close. Time has flown by – “Y2K” seems so very long ago. Looking back, there have been huge changes at the WRC. Two co-directors retired, with two new co-directors in place. Some staff have retired, and new staff have joined us. Despite the economic woes of the past year and a half, we have fared well and continue to have the resources to do our research, support our graduate program, and engage communities and stakeholders. We are fortunate that water resources will always be a priority for Minnesotans.

So what lies ahead in the next decade? Clearly, reduced financial resources will continue to challenge us. The University, like its counterparts across the country, is making tough decisions about how to position itself in this new landscape. The WRC will continue to pursue strategic partnerships with stakeholders, foundations, state and federal agencies to conduct our work. We will focus on the most important issues that confront our state and region, such as improving farming practices to better protect water quality, determining the sources of water contaminants of emerging concern, and working with the state to develop a long-term strategy for managing water resources in a sustainable manner.

Planning for a sustainable future is one of our largest efforts at the WRC. The Minnesota Water Sustainability Framework will provide guidance to the state Legislature on how to best manage the state's water resources to support ecological and human needs now and for future generations. This means developing a framework that addresses the comprehensive management of ground water and surface water, drinking water and ecological services, infrastructure needs, and adaptation to climate change. Changes to current institutional arrangements to create a more integrated management structure will be explored. We hope that this second decade of the century will result in clear planning and action for sustainable water management, and an ethic of water stewardship embraced by all.

Joy for the Holiday Season, and peace and success for the New Year,

Deb Swackhamer WRC co-director

as: population growth, land use, urban and suburban sprawl, and increasing consumption per capita, which is a more potent factor than population growth. All of these factors affect the climate, and climatic trends in Minnesota include: increasing average winter temperatures, as evidenced by a seven-degree wintertime increase over the last 30 years; lower daytime maximum temperatures with fewer days above the 90 degree mark in the summertime; a longer growing season; more ice-free days; fewer very cold winter days; and more humidity.

Schnoor said that we need to mitigate and adapt our land-and water-use practices to combat the greenhouse effect, which contributes to climate change. One of the ways he suggests is to control urban and suburban sprawl, thus reducing impervious cover, which changes where water flows on the landscape. Just a five-or ten-percent change in impervious coverage can have a significant environmental impact.

Minnesota Fourth District Congresswoman Betty McCollum spoke at the first day's luncheon about building partnerships for clean water. Ms. McCollum recalled her childhood in South St. Paul, and the smell of the Mississippi River as animal waste and other pollutants were daily dumped into the water. That waste disposal methodology changed with the passage of the Clean Water Act in 1972, which required permits for polluting, and reduced the number of direct pollutants finding their way into the nation's waters. After years of progress, federal funding for clean water programs was cut during the past decade, making enforcement of the Clean Water Act more difficult.

The congresswoman called for re-establishing clean water as a national priority, increasing funding, research, and enforcement. Water policy needs to be part of an inter-connected system, integrating air quality, land management and climate change. New priorities in Washington bode well for water quality, with President Obama requesting a 2.9-billion-dollar increase in funding for the EPA, and EPA head Lisa Jackson's announcement of a new Clean Water Action Enforcement plan and a national study on the impacts of atrazine. Although there is clear leadership on water policy from Washington, Ms. McCollum stated that real change needs to occur at the state and local levels. “The protection and restoration of our rivers, lakes, streams, and aquifers will be the result of work done one water body at a time, county by county, in every state in America.”

Paul Capel, from the United States Geological Survey and the UM Department of Civil Engineering, opened the conference's Tuesday session with his presentation “Land Use and Water Quality: Lessons from the First Two Decades of the USGS National Water Quality Assessment (NAWQA) Studies.” Capel explained the origin of NAWQA, which was created to provide information on the quality and quantity of water resources to ensure an adequate supply of water for human consumption, industry, agriculture, recreation and the ecosystem. NAWQA uses a consistent field-based, observation-based design and focuses on multiple environmental compartments, such as streams and shallow ground water. Capel highlighted stream and groundwater studies that showed pesticides in 97 percent of both urban and agricultural streams and in 61 percent of shallow ground water in agricultural areas, and in 55 percent of shallow ground water in urban areas. Atrazine and deethylatrazine

# Professor Jerry Schnoor discusses water sustainability and strategies for conservation

Q. What are most important water and sustainability issues facing the midwest and the nation?

A. The most important issues facing water sustainability have to do with climate and land-use change. Most Americans don't realize it, but climate is already changing and it is affecting people greatly. Generally, wet areas are getting wetter and arid areas are getting drier, and projections indicate it is going to become much worse through the next few decades. Most problematic in the Upper Midwest has been the trend towards more intense rainfall events and flooding. Land-use change, such as urban sprawl and intensive agriculture for biofuels, has exacerbated our water quality problems. The nation faces similar problems to the Upper Midwest except that water shortages are a much greater threat for the southwestern and mountainous-west portion of the U.S.



Photo credit: Ryan Rodgers

Jerry Schnoor speaking on the Midwest's changing water environment at the Minnesota Water Resources Conference.

Q. What are some productive strategies to encourage the agricultural community to address non-point source pollution?

A. The most successful strategies are when multiple partners share a vision and work together to achieve results. For example, Minnesota has been a pioneer in pollutant trading schemes, and you have even experimented with municipal wastewater plants purchasing credits from farmers for buffer strips and best management practices. In Iowa, when the Soybean Growers Association, the state universities, individual farmers, the Iowa Department of Natural

Resources, and the Iowa Farm Bureau have teamed together on voluntary projects for best management practices, real improvements have been achieved. Targeting of best practices to the most sensitive landscapes really works at the watershed scale. We need integrated management of water resources at the river basin scale which requires cooperation of many entities, but it is the best way to improve water quality. In the future, we should develop markets for perennial crops like prairie grasses and woody trees which require less fertilizer and pesticide and which hold the soil in place via deep root structures. Let's hope these perennials can become the next generation of crops for biorefineries, biomass for power, and biofuels.

Q. What are some strategies that could be used to encourage water conservation practices in a water-abundant state like Minnesota?

A. We are inadvertently practicing water reuse as populations grow and demands on water resources increase. Drinking water becomes wastewater, and wastewater becomes drinking water. That's the Water Cycle writ large. So we must think more holistically and systematically about our water resources. Does it make sense to draw down our confined aquifers hundreds of feet, like we are doing now with the Cambrian Ordovician

aquifer in southern Minnesota, Iowa, Wisconsin, and Illinois? It's not sustainable, and, ultimately, it points to the need for water reuse. In addition to smart water metering and pricing, water efficiency in buildings (a component of LEED), and water conservation, we need to consider recharging our aquifers with treated wastewater, by which I mean, aquifer storage and recovery, a form of indirect potable reuse. This will require high treatment efficiencies as we recycle wastewater and recharge the aquifers with the drinking water of tomorrow.

## Legislative Update

### Federal 2010 budget reflects commitment to water issues

Although the Minnesota Legislature has been quiet this fall, the 111<sup>th</sup> Congress has been considering a number of water resources-related legislation. Of primary importance to the WRC, the Department of Interior FY2010 budget has been signed into law, and the Water Resources Research Institutes program was provided \$6,500,000. This is flat funding from previous years, but important in that WRCI funding was in the President's budget for the first time in eight years.

The SECURE Water Act provisions of the Omnibus Public Land Management Act of 2009 (Public Law 111-11), Section 9507, authorizes the Secretary of Interior to provide grants for various water-related research. This passed into law in March, but was not funded in the FY2010 budget.

Three other bills have passed the House and have been referred to various Senate committees. HR 1145, the National Water Research and Development Initiative Act of 2009, directs the President to implement a National Water Research and Development Initiative to improve the federal government's role in designing and implementing federal water research, development, demonstration, data collection and dissemination, education, and technology transfer activities to address changes in U.S. water use, quality, supply, and demand, and to designate an interagency committee to implement the Initiative. HR 469 encourages research, development, and demonstration of technologies to utilize water produced in connection with the development of domestic energy resources. Finally, HR 3598, the Energy and Water Research Integration Act, aims to ensure consideration of water intensity in the Department of Energy's energy research, development, and demonstration programs to guarantee efficient, reliable, and sustainable delivery of energy and water resources. It directs the Secretary of Energy, in coordination with other relevant federal agencies, to establish the Energy-Water Architecture Council (EWAC) to provide improved energy and water resource data collection, reporting, and technological innovation.

## Urban rain gardens curbing petroleum pollution

Derived from crude oil, petroleum hydrocarbons are known to be carcinogenic to humans and harmful to aquatic life. When it rains in the city, petroleum hydrocarbons run off the streets into storm drains and in some cases into rain gardens. In a project co-funded by a National Science Foundation Research Fellowship and the Minnesota Pollution Control Agency, civil engineering graduate fellow Greg LeFevre and civil engineering professors Raymond Hozalski and Paige Novak are investigating petroleum hydrocarbon degradation in urban rain gardens – particularly rain gardens located near busy urban streets and parking lots where runoff contains automobile pollutants like gasoline, motor oil, and auto coolants, as well as leachates from asphalt sealants.

The researchers took soil samples from 75 rain garden test sites in the metro area and analyzed them for total petroleum hydrocarbons using gas chromatography. They found that the concentrations in the rain garden soils were lower than expected based on typical storm water concentrations, flows of storm water into the rain gardens, and ages of the rain gardens, suggesting that petroleum hydrocarbons are being degraded in the rain gardens. Since biodegradation depends upon bacteria to break down the petroleum hydrocarbons, LeFevre, Hozalski and Novak are now looking at whether rain gardens with higher total petroleum hydrocarbon loading rates respond with higher populations of degrader bacteria.

Over the past four years, the Water Resources Center has been a co-principal investigator in the stormwater research of University of Minnesota civil engineering professor John Gulliver and his Stormwater Assessment and Maintenance Project Team. The team is made up of faculty and students in the Water Resources Science Program, as well as the University's St. Anthony Falls Laboratory and Departments of Civil Engineering and Bioproducts and Biosystems Engineering. This study of the degradation of petroleum hydrocarbons in urban rain gardens is one of the many projects involving the support of the Water Resources Center.

### *Water Conference, continued from page 2*

topped the list of pesticides detected most frequently in agricultural stream water. Capel reported that the use of glyphosate has increased dramatically over the past decade, and NAWQA provides some of the first large-scale, multi-location data on its occurrence in surface water, ground water and the atmosphere. Capel also summarized the national findings on the levels and pathways of nitrogen, mercury and volatile organic chemicals in streams and shallow groundwater across the country and highlighted the results of the NAWQA studies that were located in Minnesota. Capel concluded that there is an important role for large-scaled water quality studies, such as NAWQA: to confirm and challenge our current understanding, to provide context to local water quality observations, to allow for extrapolation to unstudied areas, to yields surprises and raise new scientific and management questions, and to provide the motivations for the development of new tools for water quality investigations.

Rex Johnson of the United States Fish and Wildlife Service spoke at the luncheon session, addressing wetland drainage and its impacts in Minnesota. While Minnesota has lost 40 percent of its wetlands statewide, the prairie pothole region of the state often exceeds

an 85-percent reduction in pre-settlement wetlands, with 90–100 percent of the landscape now draining to streams. This loss of wetland habitat has a direct effect on the duck population, with 80 percent fewer mallard pairs, as a single pair of ducks requires one acre of wetland to survive. Landowners understandably want their land to be as profitable as possible, and that tension needs to be balanced against the societal loss of ecological goods and services. Johnson contended that the government has communicated poorly with citizens that the

environment and wildlife are essential to life, not just a component of quality of life. The solution to the problem of disappearing wetlands lies in aggressive marketing to citizens that caring for the environment is essential to good health, financial stability, and aesthetics.

Concurrent sessions and poster sessions during the conference were presented by various water professionals and UM researchers. Find a full listing of sessions and posters in the Book of Abstracts at [wrc.um.edu](http://wrc.um.edu).



Members of the 2009 Water Resources Planning Committee gather in the lobby at RiverCentre in St. Paul, MN.

Photo credit: Ryan Rodgers

## UM biologists and researchers provide Minnesota science teachers with opportunity to bring the outside world inside the classroom

All teachers look forward to their summer vacations – three peaceful months when they can dodge the spotlight and retool for the coming year. This summer, Minnesota K–12 teachers will get another option—a chance to spend a week in the field with working biologists and field researchers while receiving graduate credit at the same time.

The River Watch Boot Camp for K–12 teachers is the brainchild of University of Minnesota–Crookston (UMC) professors Dan Svedarsky and David Demuth, River Watch program coordinator Wayne Goeken, University of Minnesota Extension assistant professor Joe Courneya, and International Watershed Institute Director Chuck Fritz. The program will be partially supported by a Minnesota Outdoor Heritage Program grant.

Svedarsky, who is also a wildlife biologist with the University's Northwest Research and Outreach Center, is nationally known for his research on prairie chickens, and directs the Center for Sustainability on the Crookston campus, a co-sponsor of the session. Svedarsky is a passionate advocate of teaching, having received the Morse-Alumni Award for Undergraduate Teaching, the highest teaching award given to University of Minnesota professors.

"We believe that empowering teachers to see themselves as scientists can also transfer this excitement to their students," says Svedarsky. "And students who are excited about science not only perform better on tests, they often go on to become scientists and professionals themselves."

The camp, set for June 21–25, 2010, on the UMC campus, is designed for all levels of science teachers—from the reluctant

biologist to the intrepid field explorer. The lesson plans will be based in part on curriculum of the River Watch Citizen Monitoring Program developed by Goeken,

In addition to an unforgettable experience, teachers will receive graduate credit from the University. "Having graduate credit associated with this program will increase



Photo credit: David Arcsott

Wildlife biologist Dan Svedarsky in the field with his UM-Crookston field ecology students, exploring the same setting the River Watch Boot Camp participants will experience in June 2010.

which engages K–12 teachers and citizens in the protection of watershed ecosystems through formal and informal environmental monitoring and training programs.

Subjects will include regional geology, biology of natural and reconstructed wetlands, climate dynamics, river and stream ecology, agriculture and watersheds, sustainability principles, and scientific communications. During the day, teachers will participate in field excursions, and then join related classes and discussion groups in the afternoon and early evening. They'll learn from each other and share ideas on teaching science topics in the news—like how to calculate the carbon footprint of their school and how to make scientific connections to everyday life.

its attractiveness to teachers—especially since an advanced degree typically results in a lane change and salary boost," says Svedarsky.

Program instructors will include researchers and ecologists familiar with the regional ecology such as Dr. Phil Gerla, a ground water hydrologist who works with The Nature Conservancy's Glacial Ridge Project. Glacial Ridge is the largest prairie and wetland project in North America located ten miles from Crookston. For more information about the River Watch Boot Camp, call Svedarsky at the Center for Sustainability, 218-281-8129, or contact him at dsvedars@umn.edu.

# Community News

**Larry Baker** (WRS graduate faculty, WRC) taught at the International Institute for Water and Environmental Engineering in Ouagadougou, Burkina Faso, on the Fulbright Senior Specialist program November 10–24, 2009.

**Larry Baker** (WRS graduate faculty, WRC), **Sarah Hobbie** (WRS graduate faculty, EEB), **Kristen Nelson** (WRS graduate faculty, Forest Resources), **K.V. Cadieux** (Geography), **Paige Novak** (WRS graduate faculty, CE), and **Carissa Schively-Slotterback** (HHH) are organizing a symposium, “Urban Ecosystems and Human Well-Being: Integrating Social and Ecological Knowledge,” funded by a grant from the Minnesota Futures Program, to be held at the Continuing Education and Conference Center on the UM St. Paul Campus, January 25, 2010.

**Dan Engstrom** (WRS graduate faculty, St. Croix Watershed Research Station) traveled to Biloxi, Mississippi, in October 2009 to receive the USEPA’s Gulf Guardian Award on behalf of The Science Museum of Minnesota (SMM). The SMM received a first-place award for water quality research and its efforts to educate the public about the impact of human behavior at the start of the Mississippi on the health of the river downstream. The museum was nominated for the award by the Minnesota Pollution Control Agency (MPCA) both for its work as a premier science center in the upper Midwest and for the research that takes place at its environmental research institute, the St. Croix Watershed Research Station, which is located in Marine on St. Croix. Initiated in 2000 by the Environmental Protection Agency’s Gulf of Mexico Program, the Gulf Guardian awards are a way to recognize and honor the businesses, community groups, individuals and agencies that are taking positive steps towards keeping the Gulf healthy and productive. For more information on the program, visit: [www.epa.gov/gmpo](http://www.epa.gov/gmpo)

**Jacques Finlay** (WRS graduate faculty, EEB) and **Robert Sterner** (WRS graduate faculty, EEB) received a four-year NSF grant: “Sources and Sinks of Stoichiometrically Imbalanced Nitrate in the Laurentian Great Lakes.” The UM budget is for \$824,761. Partnering institution Bowling Green is receiving an additional \$343,290.

**John Gulliver** (WRS graduate faculty, CE) was awarded a 319 grant from the U.S. Environmental Protection Agency through the Minnesota Pollution Control Agency, “Aqueous Pollutant Capture by Enhanced Filter Media,” for \$404,000 over three-and-one-half years. The research will develop a design standard for enhancing sand and soil media that can be used in new or renovated sand filters, infiltration systems, rain gardens, and buffer strips to capture significant amounts of dissolved heavy metals, phosphorus, and nitrogen that are typically found in urban and agricultural runoff.

**Nick Haig** (Program Co-ordinator for the Onsite Sewage Waste Program) oversaw the revision of the *Manual for Septic System Professionals in Minnesota*, written to coincide with significant administrative rule revisions affecting the septic system industry in 2008. The new manual contains the latest information for septic system professionals about the design, installation and care of septic systems in Minnesota. This manual is available in its entirety online at: [septic.umn.edu/sstsmmanual](http://septic.umn.edu/sstsmmanual). It can be purchased in print at: [shop.extension.umn.edu/](http://shop.extension.umn.edu/) as item # 08650.



**Randall Hicks** (WRS graduate faculty; UMD-Biology) and colleagues from Old Dominion University, the University of Connecticut, and the University of Georgia received a four-year, \$2.3 million, collaborative research grant from NSF to investigate the role of organic-rich aggregate particles in the persistence of pathogenic microbes in aquatic ecosystems. They will evaluate whether fundamental concepts of island biogeography apply to these “microscopic islands” and bacterial pathogens that enter aqueous environments and are subsequently incorporated into these organic-rich aggregate particles.

**Thomas Johnson** (WRS graduate faculty, UMD Large Lakes Observatory, UM Regents Professor), presented the 2009 Distinguished Aquatic Scholar Lecture on October 14, 2009, at the Weber Music Hall

on the UMD campus. The title of Dr. Johnson’s presentation was “Chasing Past Climate: Tales from East Africa.” This annual lecture is sponsored by the UMD Center for Freshwater Research and Policy.

**Sergei Katsev** (WRS graduate faculty, UMD) and David Fowle from Kansas University have received NSF funding to study the geobiology, geochemistry, and physics of Lake Matano in Indonesia. The lake is host to a unique microbial community that is likely to shed light on the microbial ecology of the early Earth.

**Robert Sterner** (WRS graduate faculty, EEB) has returned to campus full-time after working for two years as Director of the Division of Environmental Biology at the National Science Foundation. Sterner is also the ASLO co-chair of the upcoming ASLO-NABS 2010 joint meeting of the American Society of Limnology and Oceanography and the North American Benthological Society to be held in Santa Fe, New Mexico, June 6–10, 2010.

**Robert Sterner** will give the Kilham Lecture at the SIL 2010 Congress in Cape Town, South Africa, August 15–20, 2010.

**Deborah Swackhamer**, co-director of the Water Resources Center, is the 2009 recipient of The Society of Environmental Toxicology and Chemistry’s (SETAC) Founders Award. The highest award given by the organization, the Founders Award recognizes outstanding career accomplishments that promote research, education, communication, and training in the environmental sciences. SETAC is a non-profit, world-wide professional organization made up of 5,000 members in 70 countries dedicated to the development of principles and practices for the protection, enhancement, and management of sustainable environmental quality and ecosystem integrity. In addition to co-directing the Water Resources Center, Swackhamer is a professor in the University’s School of Public Health and holder of the Hubert H. Humphrey Institute’s Charles M. Denny, Jr., Chair in Science, Technology, and Public Policy. The award was presented at SETAC North America’s 30th annual meeting in New Orleans, November 2009.

**Sheila Amenumey** received her Ph.D. in August 2009. Her dissertation was: "Meta-Analysis as a Statistical Tool for Evaluating the Hydrologic Effects of Subsurface Drainage Design and Water Table Management." Amenumey was advised by **Gary Sands** and **Bruce Wilson**.

**Robert Dietz** presented "Stable isotopes of carbon and nitrogen in Corbicula clams record spatial variation in aquatic DIC and nutrient sources in a Japanese lake," at the Geological Society of America Annual Meeting in Portland, Oregon, October 16–21, 2009. Dietz is advised by **Dan Engstrom**.

**Andrea Grygo** received her M.S. in August 2009. Her thesis was: "Using GIS to Examine Potential Relationships Between Landscape Variables and Mercury Levels in Fish from Superior National Forest, Minnesota." Grygo was advised by **Howard Mooers** and **Donn Branstrator**.

**Derrick Passe** presented "The Gift of Clean Water, Simajhuleu, Guatemala," at the Engineers without Borders-Midwest Regional Conference in Ames Iowa, October 25–27, 2009. Passe is advised by **John Gulliver**.

**Thomas Pevan** presented "Biological, chemical and physical parameters that affect cyanobacteria in Upper Lake St. Croix," at the St. Croix River Research Rendezvous, Marine on St. Croix, Minnesota, October 20, 2009. Pevan is advised by **Stephanie Guildford**.

**Bridget Seegers** received her M.S. in August 2009. Her thesis was: "Lake Superior Zooplankton Community Grazing and Its Implications for the Deep Chlorophyll Maximum." Seegers was advised by **Robert Sterner**.

**Jonathon Thornburg** received his M.S. in August 2009. His thesis was: "Temporal and Spatial Variability in Nitrate and Water Quality Parameters of Subsurface Drains in an Agriculture Stream." Thornburg was advised by **Paul Capel**.

Water Resources Students in Action (WRSIA) president **Jill Coleman Wasik** organized and WRSIA hosted the first annual WRS Student Symposium on October 24, 2009 at the St. Croix Watershed Research Station. Current students and recent graduates of the program gave presentations about their research, ranging from how sulfate deposition affects methylation events in peatlands, to the environmental fate of endocrine disrupting compounds, to the reconversion of restored wetlands in the southern prairie pothole region. Students also met Deb Swackhamer, and some enjoyed the beauty of the St. Croix River Valley with an afternoon hike. About 22 students, from both the Duluth and Twin Cities campuses, attended the event.

**Shannon L. Wing** received her M.S. in September 2009. Her thesis was: "Classifications of Ravine Morphometrics in the Minnesota River Basin Using GIS-based Terrain Analysis." Wing was advised by **David Mulla**.

## Minnegram

*Minnegram* is sponsored by the University of Minnesota College of Food, Agricultural and Natural Resource Sciences, University of Minnesota Extension, the USGS-USDI National Institutes for Water Resources, and the Agricultural Experiment Station. It is published quarterly by the University of Minnesota Water Resources Center; all opinions expressed within are representative of the respective authors and do not necessarily reflect the views of the supporting entities.

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**Submissions:** Minnegram welcomes articles, community news, news stories, photos, and other materials for publication.

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### January 25, 2010

#### Urban Ecosystems and Human Well-Being: Integrating Social and Ecological Knowledge

*University of Minnesota, St. Paul Campus, Continuing Education and Conference Center*

Registration is free but limited to the first 150 applicants. To register, visit: [cce.umn.edu/](http://cce.umn.edu/)

### February 3, 2010

#### Environmental Internship and Career Fair

No attendance fee or RSVP required for students. For more information and registration visit: [www.stpaulcareers.umn.edu/](http://www.stpaulcareers.umn.edu/)

### June 6–11, 2010

#### ASLO/NABS Joint Meeting

#### Aquatic Sciences: Global Changes from the Center to the Edge

*Sante Fe, NM*

To register, visit: [aslo.org/santafe2010/](http://aslo.org/santafe2010/)

### June 21–24, 2010

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

*Doubletree Hotel, Minneapolis, MN.*

For information visit: [www.seagrant.umn.edu/news/2008/09/12](http://www.seagrant.umn.edu/news/2008/09/12)

### July 13–15, 2010

#### UCOWR/NIWR 2010 Annual Conference HydroFutures: Water Science, Technology, and Communities

*The Red Lion Hotel, Seattle, WA*

For more information, visit: [ucowr.siu.edu/](http://ucowr.siu.edu/)

# Publications & Resources

**Assessment and Maintenance of Stormwater Treatment Practices.** John Gulliver, Deborah Swackhamer, Andrew Erickson, Bill Herb, Raymond Hozalski, Omid Mohseni, John Nieber and Heinz Stefan.

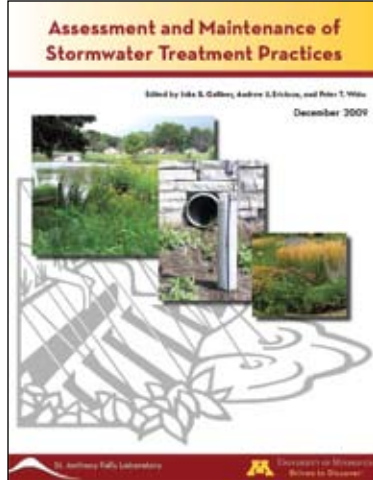
The manual is a companion to the *Minnesota Stormwater Manual* and provides techniques to assess performance and schedule maintenance, as well as describing monitoring practices, monitoring data analysis and things to consider before establishing a monitoring program. The manual is available at: [stormwater.saf1.umn.edu](http://stormwater.saf1.umn.edu).

**Water Embodied in Bio-ethanol in the United States.** Chiu, Y. and S. Suh. *Environmental Science and Technology*. This study shows that as the ethanol industry expands to areas that apply increased irrigation, consumptive

water appropriation by bioethanol in the U.S. has increased 246% from 1.9 to 6.1 trillion liters between 2005 and 2008, whereas U.S. bioethanol production has increased only 133%

from 15 to 34 billion liters during the same period. To read the article, visit: [pubs.acs.org/doi/abs/10.1021](http://pubs.acs.org/doi/abs/10.1021)

**Bringing Environmental Protection into the 21st Century.** Fiksel, J, T. Graedel, A.D. Hecht, D. Rejeski, G.S. Saylor, P.M. Senge, D.L. Swackhamer, T.L. Theis. 2009. EPA at 40: *Environmental Science and Technology* 43(23): 8716–8720.



Assessment and Maintenance of Stormwater Treatment Practices.

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