

Conference provides forum on changes in water climate

Close to 500 water professionals, citizens, and lake association leaders convened in St. Cloud from April 17-20 for the Minnesota Water 2002 & Minnesota Lakes and Rivers Conference, "Working Together in a Climate of Change to Manage Minnesota's Water Resources." Participants from federal, state, and local agencies, academia, and non-governmental organizations listened to plenary speakers address the implications of changing climate, demographics, and water- and



Tom Johnson, Director of the Duluth-based Large Lakes Observatory, described lake coring research efforts to better understand climatic patterns.

land-use patterns; intensifying development; and growing recreational conflicts for water resources management. Over 50 concurrent sessions examined technical and citizen-based topics ranging from ground water in the Twin Cities, mercury contamination in fish, and minimizing agricultural impacts, to emerging GIS tools, runoff best management practices, and shoreland landscaping (see page 5 for more details).

Global climate change: a view from MN

Plenary speakers focused on the impacts of global, regional, and local

changes on Minnesota's water resources. Tom Johnson, director of the Large Lakes Observatory at the U of M Duluth, described the role of long-term monitoring and lake coring in assessing climate changes. "Climate pattern forecasting has far-reaching repercussions for water resources management," stated Johnson, whose research on Lake Superior and the Rift Lakes of East Africa contributes to international efforts to understand climate changes.

Johnson said that long-term monitoring enables scientists to look beyond seasonal variability to inter-annual variability, and described the super-computers and climate models that scientists are using to mimic modern climatic conditions such as increased CO₂ in the atmosphere.

Mark Seeley, U of M Soil, Water, and Climate and Extension climatologist, said that extreme weather patterns, which include higher humidity indices, convective rainfall (thunderstorms), and milder winter and hotter summer temperatures, are more frequent than in the past and are affecting how precipitation-induced soil erosion and runoff impact the landscape. Seeley suggested that to manage these extremes effectively, weather forecasting efforts and understanding have to be improved.

J. Drake Hamilton of Minnesotans for an Energy-Efficient Economy said that Minnesota could see temperature increases between 2 and 10 degrees Fahrenheit by 2100 as a result of the greenhouse effect and global climate change. Higher

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Volunteer Stream Monitoring Partnership attracts 1800 volunteers

Since the Volunteer Stream Monitoring Partnership (VSMP) began its first full year of operation in 2001, the program has mobilized over 1,800 volunteers by offering hands-on stream monitoring opportunities and events. Housed in the U of M's Water Resources Center on the St. Paul campus, VSMP addresses four main areas: ensuring quality data; strengthening partner collaboration and expanding outreach; securing support to coordinate and improve volunteer stream monitoring; and assessing the needs and results of volunteer monitoring in the Twin Cities region.

In 2002 VSMP has provided training sessions to city and county employees, teachers, and students, ranging from "Introduction to Biological Monitoring" and "Advanced Macroinvertebrate Identification," to "Introduction to

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Around the State



WATER RESOURCES UPDATES

North Shore communities examine the state of the coast

by Sharon Moen, Minnesota Sea Grant

Over 140 leaders from communities along Minnesota's North Shore gathered to review regional trends in development, economics, and the environment on April 22 in Two Harbors. During the "State of the Coast 2002" conference, local authorities spoke about property values, economics, and the hospitality industry, and fielded questions about community planning and managing conflict. Discussions about meshing tourism and development activities with existing community values dominated the agenda and were complemented by insights from two speakers involved with development in the Lake Tahoe basin. Additionally, staff from agency and non-profit organizations spoke about innovative programs, opportunities, and efforts to keep Lake Superior and its watershed both clean and beautiful. "State of the Coast 2002" was the 6th spring conference coordinated by the efforts of the North Shore Consortium. The conference was made possible by a grant from the Minnesota Department of Natural Resources-Waters and Minnesota's Lake Superior Coastal Program through the federal Coastal Zone Management Act. Other sponsors and cooperators in the North Shore Consortium include: the Arrowhead Regional Development Commission, Lake County, Minnesota Land Trust, Minnesota Pollution Control Agency, University of Minnesota Sea Grant Program, and the North Shore Management Board.

Phosphorus-free fertilizer

Governor Jesse Ventura signed the phosphorus-free fertilizer bill on April 19. The new law restricts the use of lawn fertilizer containing phosphorus to zero

From the Director's Desk

Water Resources Outreach



Last December in this column, I explained that there would be major changes in the way the University of Minnesota Extension Service conducts education programming. I also indicated that this time of change would present both opportunities and challenges. Well, the state budget deficit and legislative actions turned out to be greater challenges than I had anticipated, and so this has been a difficult six months. Within the Water Resources Center we have lost four productive partnership positions with the Minnesota Department of Agriculture and Board of Water and Soil Resources (BWSR). These losses will change the way we approach education programs on nutrient and manure management in agriculture and how we lend support to statewide local water planning efforts. However, we will adapt our approach and move forward, continuing to offer the best possible education programming related to water issues. We will, along with the rest of Extension, learn to do less with less.

Fortunately, as the changes in Extension lead to more focused efforts to address the needs of Minnesota citizens and communities, we will continue to have opportunities to create partnerships and deliver the kinds of programs that are needed. To help us become more deliberate in forming partnerships and working cooperatively with state agencies, Ron Struss, an Extension Educator working with the BWSR Education Committee, led a process to enlist the help of agencies and citizens to identify program needs and opportunities for Extension. The BWSR Board, at its May meeting, endorsed the recommendations of the education committee based on the process. These recommendations include:

- Extension should consider the issues and approaches identified in these recommendations to help develop its natural resources education program. Extension should follow up with a response as to which issues and approaches will be addressed in their programming.
- Extension should pursue collaborative projects with state agency divisions concerned with these issues.
- Extension should establish contacts with other agencies and tribal governments not represented on the BWSR Board for additional input.

As the Extension Service and we at the Water Resources Center use this information to help define and guide our programs, I see an opportunity to involve a larger number of regional educators in natural resource issues than ever before. By forming teams with local and state partners to address water issues of concern, we will be able to engage expertise within Extension. This may be the silver lining—that by doing a better job of focusing our efforts around well-defined problems and issues, we will deliver fewer but more effective programs. We are already seeing this happen as we form work teams to focus on agricultural nutrient management plans, small community wastewater treatment, and shoreland management. Stay tuned to this column to read about progress on these issues and others.

Jim Anderson, WRC co-director

percent in the seven-county metropolitan area and three percent throughout the rest of the state unless a soil test shows that phosphorus is needed or the lawn is new.

A soil test, using a mail-in kit, would be good for three years. Certified turf managers for golf courses are exempt.

Excerpted from MLA Legislative Alert

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Chemical Monitoring.” Once trained, volunteers are able to monitor the water quality in metro area streams. VSMP staff continue to work closely with local coordinators and volunteers to ensure quality data. Quality assurance measures are clearly stated and quality checks are performed at all levels.

This summer, a major accomplishment for VSMP will be the launch of the Met Council database that will house all of the current and historic stream data collected by volunteers in the metro area. VSMP staff will verify the data before it is entered into the database. Ultimately, volunteers themselves will be entering their results and generating reports online.

A highlight for 2002 will be the Second Annual River Summit to be held November 14, 2002, at the Minneapolis Convention Center. This event will build on last year’s River Summit where over 230 students



High school students conduct a stream-side inventory of aquatic organisms during a VSMP event (Anoka Conservation District).

and teachers, natural resource professionals, elected officials, nonprofit organizations, and individuals from the private sector participated in a day of data sharing and presentations, networking, and celebrating the work of volunteers.

Working through a coalition of water educators called The Watershed Partners, the Metropolitan Council awarded a multi-year start-up grant of \$400,000 to fund VSMP, and the Water Resources Center offered to provide administrative support and infrastructure. The volunteer network continues to expand. With the addition of several groups in Scott County that will be joining the partnership this fall, volunteer monitoring will be going strong in six of the seven metro counties.

Urban conservationist embraces low impact development for stormwater management

by Jay Riggs, Dakota County Soil and Water Conservation District

The effectiveness of innovative stormwater management practices in our cold climate is a hot topic. When Minnesotans discuss Low Impact Development (LID) and other runoff volume reduction techniques, a variety of questions arise: What happens when the snow melts? Where and how is snow stored? What are the impacts of salt and sand? Can mosquito populations be controlled? Can LID work in Minnesota’s climate?

LID attempts to balance growth and environmental integrity by integrating ecological and environmental considerations into all phases of stormwater management planning, design, and construction. LID techniques provide opportunities to protect surface and ground water quantity and quality, and maintain and preserve the integrity of aquatic living resources and ecosystems. LID’s goal is to mimic a site’s predevelopment hydrology by using design techniques that infiltrate, filter, store, evaporate, and detain runoff close to its source. Examples of LID for stormwater management include bioretention facilities such as raingardens, permeable pavements, and street tree filters.

Many LID techniques work regardless of climate: a few examples are protecting natural areas, avoiding soil compaction, and reducing impervious areas. Management of runoff during the snowmelt is an important consideration because precipitation and pollutants accumulate and are released during snowmelt events, usually during the spring. Many techniques are used to deal with snowmelt in Minnesota, such as using alternative de-icing chemicals, storing snow where it can infiltrate, blowing snow to pervious areas, operating stormwater ponds on a seasonal basis, and implementing intensive street cleaning programs. Some cold-climate considerations for infiltration basins include basin over-sizing and providing extensive or redundant pretreatment. However, there are few local studies about how best to modify the design and management of LID practices in Minnesota. Fortunately, many questions can be answered by referring to other parts of the world where people have been implementing and studying LID-like practices for years.

In any climatic system, LID design and operation must be conducted for seasonal site conditions. Flows must be calculated for both summer and winter conditions, and stormwater management practices must be designed accordingly. For example, in the winter it is necessary to assume near 100% imperviousness due to frozen ground conditions. Areas designed for infiltration should be protected from excessive snow storage where sand and salt is applied. Specific soil storage areas need to be assigned that will provide some filtration before the storm water reaches the infiltration areas.

Additional research also is needed. Controlled studies to assess the long-term effectiveness of LID practices and optimal management strategies should be conducted. Wherever communities are implementing LID practices in Minnesota, they need to carefully monitor these areas and share their knowledge with others in order to enhance stormwater management and protection of lakes, rivers, and wetlands.



Bioretention parking lot island (Low Impact Development Center)

Conference continued from page 1

temperatures are predicted to cause forest death, loss of cold-water fisheries, increased opportunities for exotic species, an increase in the frequency and size of floods, and agricultural disruptions. According to Hamilton, reducing greenhouse gas emissions through the use of clean energy, higher fuel efficiency, and renewable fuels may mitigate global warming.

More humans, more water woes

Human population growth and development patterns are increasingly affecting water resources management. John Wells of the Minnesota Sustainable Development Initiative highlighted the state's population growth trends and suggested steps to move Minnesota toward more sustainable social and economic systems. Minnesota's population reached 5 million in May 2002. Wells said government is sending the wrong signals by rewarding unsustainable growth, and cited a general "reluctance to determine sustainable yields of water" as having implications for water resources management. Govern-



Metropolitan Council's John Kari discussed the need to educate communities about the benefits of controlling growth.

ment can send the right signals, said Wells, by targeting limited resources for conservation, implementing policies and regulations that promote sustainable practices, and rewarding sustainable behavior. He also used the Presidential Council's philosophy on growth to outline sustainability, "Certain elements must grow: jobs, productivity, wages, capital and savings, profits, information, knowledge, and education, while others—pollution, waste and poverty—must not."

John Kari of the Metropolitan Council

addressed growth and planning strategies for the 21st century. Concentrating growth of living and business space along existing corridors while increasing road efficiency and public transit can improve



Bill Easter, U of M Applied Economics, said that increased competition for groundwater may induce private sector-based management through the use of water markets.

the livability of corridors by creating more neighborhood-like atmospheres. Said Kari, "We cannot avoid new development, but we need to limit the amount of new infrastructure being constructed. Plans for growth need to be translatable at the local level in order to be effective; communities need to be educated about the benefits of controlling growth."

The political economy of water

Bill Easter, U of M Applied Economics, discussed the impact of shifting economic realities on water resources management. Easter predicted that the major challenge facing water and other natural resources sectors will come from the growing urban population's demand for open space and safe drinking water. Recent surveys indicate that people are willing to pay for improved water quality, whether by installing water cleaning devices, drinking bottled water, or higher water bills. According to Easter, increasing public pressure to clean up non-point source pollution marks a major change in public philosophy. He cited the recent passage of legislation that requires phosphorus-free lawn fertilizer for use in the metropolitan area by 2004 as an example. Groundwater provides drinking water to 70% of Minnesotans and increasing competition for this resource may induce private sector-based management through the use of water markets, said Easter.

Gyles Randall, U of M Southern

Research and Outreach Center, discussed the ecological, sociological, and economic sustainability of present-day agriculture in southern Minnesota. He focused on the repercussions of the shift from a more diversified mixed cropping system to a corn and soybean cropping system. Describing this shift as one of great concern, Randall said that the "present-day corn and soybean production system does not appear to be sustainable," citing reasons such as international competition, soil erosion, decreased biodiversity, pest problems, nitrate loss, transportation obstacles, and shrinking rural populations.

Dennis Anderson, a Minneapolis Star Tribune journalist, provided a personalized account of his growing concern for the status of Minnesota's water resources, which led to a major series of articles published last December. Anderson described the degradation of surface waters as a result of constant and increasing pressures generated by humans, which he has witnessed throughout his life in Minnesota.

Jack Uldrich and Gretchen Sabel, Minnesota Planning, highlighted the challenges and opportunities of managing the state's water resources in the midst of the \$2.3 billion budget shortfall and upcoming elections. Uldrich said that the goal of Minnesota's Water Unification Plan is to unite water resources management efforts "under the single flag of the



Mark Seeley, U of M professor and Extension climatologist, discussed the need for adaptive management in response to the greater frequency of extreme weather events.

State water plan." Sabel described the plan as an effort to "build a common framework of understanding to bridge different organizations' needs and ideas."

Water conference concurrent sessions

Presenters use research, technology, and policy to improve water resources management

Concurrent and poster sessions at the Minnesota Water 2002 & Minnesota Lakes and Rivers Conference revealed the diversity of research relevant to water resources management that is being conducted in Minnesota. The following



Conference participants exchange viewpoints during the poster session.

article provides an overview of selected concurrent sessions attended by Minnegramp staff. The book of abstracts for the conference is available at the WRC Website: <http://wrc.coafes.umn.edu/water2002/abstract2.pdf>

Managing growth and natural resources

A common theme of many sessions was the application of information to growth strategies. Steve Kloiber, Metropolitan Council, presented resource valuation examples using regional data sets analyzed for the Twin Cities Natural Resource Inventory, which included land cover, biological diversity, unique species, streams, lake morphometry, and recreational data to illustrate the relationship between data quality, data source, and effective policies and programs to preserve and protect water resources. Dave Pitt, U of M Landscape Architecture, discussed planning processes to incorporate environmental values into growth and development. He described a process to assess the biological, physical, hydrological, and cultural structure of landscapes as a guide to development.

Kelton Barr, Kelton Barr Consulting, presented the challenges of balancing the historic and spiritual significance of a water resource against infrastructure needs. He outlined the controversy over Camp Coldwater Spring and the construction of the Highway 55 interchange nearby.

The Shoreland Landscaping Matters session focused on shoreland buffers as a way to protect lake and river quality. Presentations included a demonstration by Jan Wolf, DNR, of the new "Restore Your Shore" CD-ROM; a presentation on shoreland design methods by Julie Klocker, U of M Extension Service; and an overview of shoreland restoration tax incentives by Cheryl Bursik, Dragonfly Consulting.

Water health and contamination

A variety of studies were presented that reveal linkages between water pollution and harmful impacts on living organisms. Kathy Lee, U.S. Geological Survey (USGS), documented the occurrence of industrial and household chemicals and pharmaceuticals in Minnesota waters. Fifty-eight of the 63 industrial and household chemicals they analyzed for were detected in samples collected during 2000-2001, while 14 of the 26 pharmaceuticals analyzed for were detected.

Deb Swackhamer, U of M Environmental and Occupational Health, investigated effects of environmental estrogens on fish. Synthetic hormones and some pesticides are increasing the levels of estrogenic compounds in surface water. Research on wild fish downstream of a sewage plant reveals that there are fewer male fish and existing males have reduced sperm and smaller gonads.

Presentations on mercury contamination in fish focused on processes that contribute to methyl-mercury generation, bioaccumulation, fluctuations, sources and sinks of mercury. Laurel Woodruff, USGS, investigated mercury in bedrock and soils in Voyageurs National Park. Samples confirm that the primary source of mercury to the park is atmospheric

deposition. Mercury binds to organic matter, and organic-rich soils in forested watersheds act as significant mercury sinks. Jim Cotner, U of M Ecology, Evolution, and Behavior, hypothesized that acid deposition has increased the flux of sulfate into lakes in northern Minnesota. This may increase sulfate-reducing bacteria that facilitate mercury methylation in lake sediments and wetlands. Cotner said there has been a two- to three-fold increase in mercury in Minnesota's lakes since 1850, and a ten-fold increase in mercury in fish since 1930. Jeff Jeremiason, Minnesota Pollution Control Agency (MPCA), described work on methylmercury bioaccumulation in aquatic food chains, while Mark Brigham, USGS, discussed how improved understanding of methylmercury occurrence and cycling could lead to better water resource management.

Two breakout sessions on potential causes of frog malformations included research on the role of minerals in frog development, physical factors influencing habitat, and the role of parasites. Studies



Steve Kloiber, Metropolitan Council, described the relationship between data quality and water policy.

on the relationship between potassium and sodium concentration and tadpole development and surveys of wetlands deficient in critical minerals offer possible explanations for malformed frogs.

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U of M Water Community News

CURA arsenic and groundwater grant awarded to WRS student and advisor

Mindy Erickson, Water Resources Science Ph.D. candidate, and her advisor, Randal Barnes (Civil Engineering), were awarded a one-year grant from the U of M Center for Urban and Regional Affairs to determine the impact of arsenic in Minnesota groundwater on drinking water supply.

The study entails gathering data from the field and assembling existing data. The research will contribute to the identification of field geologic indicators of likely high arsenic levels in well water, and development of new regulations and guidelines for installing and sampling drinking water wells in high arsenic areas.

Jim Perry (Fisheries, Wildlife, and Conservation Biology) visited Yalta to lead a workshop on eutrophication and water quality management in the Black and Caspian Seas.

Ph.D. student **Rachel Walker** (Water Resources Science [WRS]), and M.S. student **Anne Jefferson** (WRS) have been awarded three-year fellowships from the National Science Foundation to pursue their graduate work.

M.S. student **Matt Hudson** (WRS and Sea Grant) has received the 2002 Scholarship from the International Association for Great Lakes Research (IAGLR) for his thesis research on the role of bacteria in the transfer of PCBs in the foodweb of Lake Superior.

Ph.D. recipient **Thomas Jabusch** (WRS) was awarded the 2002-2003 Great Lakes Commission-Sea Grant Fellowship in May, 2002.

Susan Galatowitsch (Horticultural Science) was awarded a Fulbright fellow-

ship to be a visiting lecturer/researcher at the University of Cape Town July 2002-June 2003. Galatowitsch will teach restoration ecology and conduct research on the removal of high water-consuming exotics from riparian corridors as a way to increase base flow to streams and the use of native revegetation following exotic species removal in an effort to catalyze recovery of these systems.

M.S. student **Heather Hendrixson** (WRS) was awarded Dayton and Wilkie Natural History Funds and a LiMNology fellowship for her research on biological stoichiometry of fish across trophic gradients in lakes.

In April, **Patrick Huelman** began serving as Interim Associate Dean for the College of Natural Resources. In this role Huelman will lead the U of M Extension Service's Natural Resources and Environment capacity area, and will be responsible for the college's continuing education efforts.

Emi Ito (Limnological Research Center), who served as Acting Director, was appointed to the position of Director for a 3-year term effective May 2002. Ito is an invited speaker at the 2002 Goldschmidt Conference in Davos, Switzerland, for a special session, "Biogeochemical processes in lakes."

Roger Arndt (Civil Engineering) received the Distinguished Engineer of the Year award from the Minnesota Society of Professional Engineers.

Efi Foufoula-Georgiou (Civil Engineering) is one of four U of M professors to be named a Distinguished McKnight Professor. The distinction honors the University's "highest-achieving faculty who recently have attained full professor status."

David Tilman (Ecology, Evolution, and Behavior) was elected to the National Academy of Sciences. Election to membership in the Academy is considered one of the highest honors that can be accorded to a U.S. scientist or engineer.

Spring 2002 University of Minnesota Water Resources Science Program Degree Recipients

Thomas Jabusch received a Ph.D. in May 2002. Deborah Swackhamer (Environmental and Occupational Health) was Jabusch's advisor. His dissertation title was "Mechanistic studies of the bioaccumulation of polychlorinated biphenyls in phytoplankton."

Keith Fredrick received a M.S. in April 2002. Jim Perry (Fisheries, Wildlife, and Conservation Biology) was Fredrick's advisor. Fredrick's thesis title was "Impacts of forestry best management practices on water quality and benthic macroinvertebrates."

James Noren received a M.S. in April 2002. Noren's thesis title was "The effects of a change in withdrawal operations at Eau Galle Reservoir, Wisconsin, USA." He was advised by Patrick Brezonik (Water Resources Center and Civil Engineering).

Feng (Andrew) Fang received a Ph.D. in June 2002. His dissertation was titled "Phosphorus retention by soils and suspended sediments in the Minnesota River Basin." Patrick Brezonik (Water Resources Center and Civil Engineering) was Fang's advisor.

Professors **William Arnold** (Civil Engineering) and **Kristopher McNeil** (Chemistry) and graduate students **Doug Latch** (Chemistry) and **Jennifer Parker** (Civil Engineering) found that triclosan, a common antimicrobial compound found in soaps, produces 2,8-dichlorodibenzodioxin during laboratory photolysis studies. Although this compound is not a potent dioxin, chlorination of the parent triclosan may lead to the formation of higher chlorinated dioxins upon photolysis.

Presentations continued from page 5

Several presentations focused on assessing sources and effects of nutrients on water bodies. Steven Heiskary, MPCA, used diatoms to reconstruct phosphorus concentrations from lake sediment cores to examine temporal and spatial trends in eutrophication issues. James Johnson, Three Rivers Park District, presented results from a study that monitored total phosphorus loading in Medicine Lake from residential runoff from six neighborhoods in the watershed. The monitoring will help measure the effectiveness of the recently adopted phosphorus fertilizer ordinances by comparing the new monitoring data with data collected prior to the adoption of the ordinances.

Monitoring and assessment techniques

John Kingston investigated the use of sediment cores to reconstruct nutrient loading in Jessie Lake, Itasca County. The study provides a context for understanding the current nutrient status of the lake in terms of land-use changes.

Dave Thoma, U of M Soil, Water, and Climate, outlined a new method to quantify bank erosion on the Blue Earth River, which contributes 54% of the sediment load to the Minnesota River. Using scanning laser altimetry, a technique that measures topography and volume change in riverbanks, databases are being created that will provide an estimate of sediment load due to bank erosion.

Paul Wymar, Chippewa River Watershed Project, described a data collection effort designed to identify priority areas for project development. Transparency tube readings revealed geographically relevant water quality trends for several Chippewa River tributaries. Wymar described the data collection method as “reliable, cost effective, and simple to use.”

Leif Olmanson, U of M Water Resources Center (WRC), discussed the role of satellite imagery in lake management. He showed a map classifying the water clarity of over 10,000 lakes using 15 Landsat images to cover the state.

LeeAnn Johnson, U of M Soil, Water, and Climate, described the use of DNA fingerprinting in fecal-source tracking in water. The technique has enabled researchers to identify fecal coliform sources and place them into groups such as domestic, farm animals, and water fowl.



Jim Anderson, Water Resources Center, and Ron Struss, Board of Water and Soil Resources and U of M Extension Service, discuss the concurrent sessions.

Larry Baker, WRC, described how information engineering is improving the response time, monitoring, and management of environmental problems through the generation of and access to huge amounts of data. Baker described the development of a rapid response system for managing taste and odor problems in the water supply, development of a feedback system to enable farmers to account for nitrate in pumped groundwa-

ter and decrease fertilizer application rates, and the use of satellite imagery to improve fugitive-dust emission modeling.

Agriculture and water

Sessions on minimizing agricultural impacts focused on research into nutrient and pesticide losses from tiling, nonpoint source pollution abatement policy, herbicides, and fish communities. Bill VanRyswyk, Minnesota Department of Agriculture, detailed efforts to monitor subsurface tile discharge as a method to evaluate different agricultural management strategies to improve water quality.

Mary Renwick, WRC, discussed a study to link water quality modeling with economics to enhance nonpoint pollution abatement policy. Dealing with scientific, economic, and political issues, the study identifies and measures the linkages between production decisions, profits, and water quality using models of farm-level processes within a watershed context.

Song Wang, U of M Civil Engineering, presented research to show that abiotic reduction is a key degradation mechanism of dinitroaniline herbicides under typical groundwater conditions. Recognized as contaminants, these herbicides are widespread throughout the Midwest.

Julie Zimmerman, U of M Fisheries, Wildlife, and Conservation Biology, investigated the effects of agricultural practices on fish communities using computer simulation models and in-stream suspended sediment concentrations. While a decrease in lethal effects of suspended sediment on fish in Wells Creek was correlated with an increase in conservation tillage, riparian buffers, and permanent vegetative cover, land-use changes in the Chippewa River did not decrease the effects of suspended sediment on fish.

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Upcoming Events and Publications



Upcoming Events

September 23-25. **Challenges in a Diverse Landscape.** Hinckley, MN. This local water planners conference will focus on wastewater management, land-use decision making, managing disasters, and other water planning issues. Emphasis will be on programs that can be adapted to other locations, and Minnesota/Wisconsin initiatives that further the work of local water planning. Contact Mary Darragh Schmitz for more information at manschmi@co.chisago.mn.us.

October 8-10. **Unsteady Flow Modeling Using HEC-RAS Version 3.1.** This three-day course is designed to provide the participant with an understanding of new program features for unsteady-flow modeling. Participants will learn the steps required to process geometry files, add unsteady-flow boundary conditions, set up and process an unsteady-flow, and evaluate results. Contact Ruth Martin for more information: Tel: (612) 624-3492, or E-mail: rmartin@cce.umn.edu.

Publications and Resources

Satellite and GIS Tools to Assess Lake Quality. Technical Report 145. 2002. Water Resources Center. This report examines key issues involved in using satellite imagery in the regional assessment of lake clarity, the development of a procedure for use of Landsat imagery to assess lake water clarity, and the application of the procedure to a series of images of lakes in the Twin Cities Metropolitan Area taken during a 25-year period (1973-1998). To access the report, visit: <http://wrc.coafes.umn.edu/research/conducted.htm>.

Cooperative Management Plan—Lower St. Croix National Scenic Riverway. 2002. Minnesota and Wisconsin Departments of Natural Resources, and U.S. Department of the Interior, National Park Service. A new look at the management of the river to address today's problems, the plan describes management directions for the next 15-20 years. For more information, visit:

<http://www.dnr.state.mn.us/waters/wsriivers/lscmgplan.html>.

Elemental chemistry of streambed sediments of the St. Croix River Basin 2000. 2002. Water-resources investigations report 02-4087. U.S. Department of the Interior and U.S. Geological Survey. Streambed sediments from 30 sites in the St. Croix River Basin were analyzed for selected chemical elements. The report describes possible occurrences of low-level contamination. For more information, call (888) ASK-USGS.

Estimates of recharge to unconfined aquifers and leakage to confined aquifers in the seven-county metropolitan area of Minneapolis-St. Paul, Minnesota. 2002. U.S. Department of the Interior and U.S. Geological Survey. This report presents quantitative and qualitative estimates of recharge to unconfined aquifers and leakage to confined aquifers in the study area. For more information, call (888) ASK-USGS.