
Three university grants awarded by the WRC

Three research projects were selected for funding in the 2001 grant competition sponsored by the Water Resources Center (WRC). The three studies aim to further understanding of the following issues of concern in Minnesota: lake ecosystem response to climate change, recent trends in lake water conditions as determined from sediment cores, and the presence of fluorochemicals in Minnesota. Funding for the projects is provided by the Water Resources Research Institutes program of the USGS, and the Center for Agricultural Impacts on Water Quality, a program of the College of Agricultural, Food, and Environmental Sciences.

Paleohydrologic response of the Mississippi Headwaters watershed to Holocene climate change

The Mississippi Headwaters watershed contains three large lakes, Cass, Leech, and Winnibigoshish, which are hydrologically integrated with the Mississippi River. Though all three lakes lie in the same watershed and have had essentially the same climate, vegetation, geology, and topography throughout the Holocene Epoch, Winnibigoshish has aeolian glacial sediments while Cass and Leech lakes do not. This suggests that: 1) lakes can show a wide range of responses to similar climatic inputs; 2) the hydrological budget of lakes is largely a function of the basin:lake ratio; and 3) synchronous differences in sediment records reveal differences in the hydrologic budget and residence time of lakes. Howard Mooers, associate professor in Geological Sciences, UMD, was awarded a grant to collect and analyze sediment cores from these three lakes to

reconstruct a record of paleohydrology and paleoclimatology of the Mississippi Headwaters area. Mooers intends to assess the paleohydrologic response of large lakes to increased aridity and determine lake ecosystem response to changes in hydrologic budget and nutrient fluxes.

Eutrophication and remediation in context: high-resolution study of the past 200 years in the sedimentary record of Lake McCarrons (Roseville, MN)

Lake McCarrons is a eutrophic urban lake that has been the focus of several unsuccessful remediation efforts to reduce phosphorus loading. Annually laminated (varved) sediment cores have been shown to be a reliable high-resolution recorder of catchment and in-lake dynamics such as redox, salinity, productivity, and circulation. Long records of lake conditions can be useful to lake managers by providing records for validating or calibrating models of mixing and stratification or nutrient and chemical budgets. They can also demonstrate the range of variability in pre-impacted lake systems and preserve trends in lake conditions for time scales longer than those produced by instrumental records. Emi Ito, professor in Geology and Geophysics, was awarded a grant to produce an annual-resolution, 200-year record of lake water quality variability from a sediment core taken from Lake McCarrons. This information will allow lake managers to develop more realistic goals for lake water quality, and to focus

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Scientists to develop environmental indicators for the Great Lakes

by Gerald Niemi, Natural Resources Research Institute

The US Environmental Protection Agency (EPA) recently awarded a \$6 million grant to a consortium of ecological scientists from across the Great Lakes, led by Gerald Niemi, director of the Natural Resources Research Institute's (NRRI) Center for Water and the Environment (CWE), to develop environmental indicators for the Great Lakes. This grant is the largest ecological grant ever awarded by the EPA's Science to Achieve Results (STAR) research program. The four-year project, "Development of Environmental Indicators of Condition, Integrity, and Sustainability in the Great Lakes Basin," will identify, evaluate and recommend a portfolio of environmental indicators to measure the condition of the coastal and near shore zones of the Great Lakes.

"At the end of the four-year period, we will provide recommendations to the

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Around the State

WATER RESOURCES UPDATES

Limnology retreat answers the question "So what?"

The third annual LiMNology Science retreat took place February 24–25 in Siren, Wisconsin, drawing together limnological researchers from around the state. This two-day retreat, entitled "LiMNology Science 2001: So What?", featured presentations describing recent findings and goals of newly funded research projects, and reasons why this research is important. Topics included nutrient dynamics in lakes and streams, control and impact of invasive species,

lake core drilling in Lake Malawi, Africa, and the organization and goals of the new NRRI project (see story on page 1).

Water Resources Center publishes 1998-2000 Biennial Report

The Water Resources Center recently published its biennial report for 1998–2000. This report describes projects, activities, and accomplishments of the WRC in the areas of research, outreach, education, and public service. For a copy of the report, contact the WRC at (612) 624-9282.

Finance workshop addresses ability of small water supply facilities to meet drinking water standards

Minnesota has over 625 small water systems (systems serving populations of up to 10,000 people). Aging water facilities in small communities need increasing investments to meet amendments to the Safe Drinking Water Act and water demands associated with economic growth and development. Costly investments required to meet such environmental standards could stress small communities with limited financial resources. To address this issue, the University of Minnesota's Water Resources Center sponsored a half-day workshop, entitled "Financing Capital Improvements," at the 17th Annual Minnesota Rural Water Association Technical Conference. Approximately 600 people working with community water supply systems in Minnesota attended the conference, which was held March 6–8, 2001, at the St. Cloud Civic Center.

The workshop examined financing mechanisms to meet capital investment

requirements using a strategic management approach. This approach entails identifying challenges facing community water supply systems, evaluating risk factors, understanding financing alternatives and mechanisms, developing awareness of the role of regulatory commissions in overseeing capital investments, and identifying how water industry trends and associated financial implications impact community water supply systems. Patrick Mann, a national expert on water system financing and an economics professor from the University of West Virginia, gave the keynote address. According to Mann, "Failure to obtain adequate and timely capital financing may have a detrimental effect on the overall financial viability of water utilities and impede compliance with environmental legislation and ability to meet customer needs."

Karla Peterson, MN Department of Health, discussed challenges facing Minnesota's community water supply systems, including treatment of arsenic, radon, and radium. Communities can estimate the potential costs of treatment for these contaminants using arsenic costs as a baseline by going to the following website: <http://www.awwarf.com/research/standardcontract.html>. Becky Sabie, Public Facilities Authority, described loan programs suitable for financing community water systems. Kathryn Jones, Heward R. Green Consulting, discussed how community water systems can increase water rates and change rate structures to increase revenues. Jones suggested that communities raise rates by a small amount each year rather than large increases every 5-10 years to avoid "sticker shock." Ellen Longfellow, an attorney with the League of Minnesota Cities, advised participants about securing

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Geolimnological community loses esteemed member

By Tom Johnson, Large Lakes Observatory, UMD

Professor Kerry Kelts passed away on February 8, 2001, at the age of 54 after a long and courageous battle with Hodgkins Disease. Kerry was a professor in the Department of Geology and Geophysics



Photo courtesy of Doug Schnurrenberger

at the University of Minnesota and was the director of the University's Limnological Research Center from 1990 to

2000. He received his B.S. in Geophysics from the University of California-Riverside in 1967 and his Diploma (1970) and Ph.D. (1978) from the Swiss Federal Institute of Technology, Zurich (ETH). Kerry became interested in the geological aspects of lakes as a graduate student and undertook a comprehensive investigation of the large, alpine glacial lakes, Zurich and Zug. This work resulted in classic papers on topics ranging from sedimentary structures and physical processes of sedimentation to the carbonate mineralogy and geochemistry of lake basins. Kerry also participated in three legs of the Deep Sea Drilling Project as a graduate student, where he gained extensive experience in the marine realm. This undoubtedly helped to shape his vision for lake research on a global scale. Kerry was a post-doctoral scholar with the Deep-Sea Drilling Project at Scripps Institution of Oceanography from 1978 to 1980, a lecturer at ETH-Zurich from 1980 to 1985, and the director of the Geology Group at the Swiss Federal Institute of Water Resources (EAWAG) from 1985 to 1988. He became the director of the Swiss Institute of Climate and Global Change in 1988, a post he held until coming to

Minnesota in 1990.

During the 1980s, Kerry initiated what was to be one of his scientific passions: the global study of modern and ancient lake basins. He defined and coordinated two highly successful International Geological Correlation Programs (IGCP): first, Project 219 (Comparative Lacustrine Sedimentology in Space and Time) and then GLOPALS (Project 324—Global Paleoenvironmental Archives in Lacustrine Systems). Kerry believed strongly that one of the major goals of these programs should be to stimulate lake-related research in some of the remote parts of the world. To this end he was tireless in his efforts to raise the funds that allowed participants from developing countries to attend IGCP project workshops, sometimes contributing to their travel expenses from his own pocket. This global vision led Kerry to conceive the term “limnogeology,” and he can be considered the father of this new and thriving field in the geosciences. He was a founder and first president of the International Association of Limnogeology and the prime mover behind the first International Limnogeology Congress, held in Copenhagen in August 1995. Four years later, at the second ILC congress in Brest, France, Kerry was awarded the first IAL medal in recognition of his pioneering role in defining and promoting the science of limnogeology.

Kerry authored more than 80 publications and co-edited *Lacustrine Petroleum Source Rocks* in 1988, *The Phanerozoic Record of Lacustrine Basins and their Environmental Signals* in 1989, and *Lake Basins Through Space and Time* in 2000. He has had major impact on the strategy employed by industry to explore ancient lacustrine basins for new oil reserves. He was the co-founder of the International Decade

USGS develops faster method for estimating streamflows

Estimating streamflows in areas where there are no gages once took days but now only takes minutes thanks to scientists at the US Geological Survey who have developed a user-friendly streamflow-estimating system called “Streamstats.” The system can be accessed on the internet (<http://ma.water.usgs.gov/streamstats>), and uses an equation-based method for estimating statistics to indicate the range of streamflow that can be expected at user-selected sites. A pilot project has been completed in Massachusetts. The USGS plans to implement this service nationwide as part of its National Streamflow Information Program.

“With this new web-based tool, users can view maps of areas of interest. They need only to select a site on a stream to get estimates of streamflow statistics,” said USGS hydrologist Kernell Ries, the principal investigator. “Automatically, the physical characteristics of the watershed that drains the site will be measured, a set of equations will be solved, and the estimated streamflow statistics and a location map will be provided to your desktop within seconds.” Previously, Ries said, users of

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for the East African Lakes (IDEAL) and most recently provided the driving force for the construction and successful testing of GLAD 800, a portable drilling system that is revolutionizing the field of paleolimnology. As a tribute to Kerry, the LRC has named the modular barge that supports the GLAD 800 drilling system the *RV Kerry Kelts*.

EPA sets first-ever water quality criteria for nutrients and methylmercury

For the first time, the U.S. Environmental Protection Agency is setting water quality criteria for nutrients and methylmercury. Nutrient criteria, including nitrogen and phosphorus, will serve as recommendations to states and tribes for water quality standards. States are expected to adopt or revise their nutrient standards by 2004, based on the new criteria. EPA's 1998 water quality report to Congress listed nutrients as a leading cause of water pollution, and states reported then that excessive nutrients had degraded almost 3.5 million acres of lakes and reservoirs and over 84,000 miles of rivers and streams to the point where they no longer met basic needs such as supporting healthy aquatic life. The new criteria are expected to significantly reduce nutrients in the nation's waterways.

The water quality criteria for methylmercury, the form of

mercury found in contaminated fish, are to be used by states in determining methylmercury levels in fish tissue. The new methylmercury water quality criteria are based on a new risk assessment (a reference dose) that EPA developed in response to last summer's recommendation by the National Academy of Sciences. Both the new criteria and the new reference dose are based on updated scientific data on environmental fate and human health effects of methylmercury.

For more information about the criteria for nutrients and methylmercury, visit <http://www.epa.gov/ost/standards/nutrient.html> and <http://www.epa.gov/ost/criteria/methylmercury/>, respectively.

Excerpted in part from two EPA WaterNews news releases.

Graduate students critical to MN Sea Grant research

Twelve graduate students at the University of Minnesota will help conduct research with \$588,000 provided by Minnesota Sea Grant over the next two years. The recipients of these graduate research assistantships (GRAs) will study issues related to Lake Superior and Minnesota's inland lakes under the supervision of University professors.

The assistantships are awarded to emerging scientists who demonstrate outstanding academic achievement and who are involved in research projects concerning biotechnology, aquaculture, coastal communities, exotic aquatic species, and the Lake Superior ecosystem. The GRAs were awarded in February to eight University departments and are over and above the research monies the departments receive from Sea Grant.

Erik Brown, associate professor in the Department of Geological Sciences, UMD, and at the University of Minnesota's Large Lakes Observatory, and his collaborators will work with two graduate students as they examine the dispersal of sediments from the Nemadji River into Lake Superior. "These fellowships help us attract quality graduate students to study Lake Superior," said Brown. "Graduate students are critical to our research accomplishments. Field and

laboratory work are time-consuming and, in many cases, time-dependent. With the other responsibilities associated with academic appointments, we simply wouldn't be doing as much research without graduate students. They, in turn, gain valuable experience."

Svetlana Kostic is one of the GRAs supported by Brown's collaborative research. Kostic is pursuing a Ph.D. through the University of Minnesota's Saint Anthony Falls Laboratory, working with professor Gary Parker. "Besides being a standard means of support for graduate students, a research assistantship offers a unique opportunity to be involved in intellectually-challenging projects of great practical value," Kostic said. "Each research project tests motivation, organizational skills, and eagerness to learn. For all of us who are pursuing not only the degree but also our dream of genuine scientific accomplishment, the research process itself is exciting enough to compensate for many difficulties."

Aside from cutting-edge research, Sea Grant-supported graduates are expected to communicate the importance of their work to the public. This addition to a traditional GRA emphasizes the importance of making science relevant and accessible. The research assistants will work with Sea Grant staff on activities such as crafting non-academic publications and hosting public activities.

Minnesota Sea Grant News Release

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efforts on more effective strategies.

Fluorochemicals in Minnesota waters: an emerging environmental issue

Fluorochemicals are used in several industrial polymers such as Teflon and Scotchgard. These chemicals, despite their stability, low vapor pressure, and hydrophobicity, can enter the environment through pathways such as volatilization and leaching from textiles during washing. Perfluorooctanesulfonate (PFOS), a breakdown product of Scotchgard, has been found in the blood of people around the world as well as in aquatic biota, water and air, suggesting that it is a persistent bioaccumulative compound of global concern. Concentrations of PFOS in Minnesota are currently unknown. Matt Simcik, assistant professor in Environmental and Occupational Health, was awarded a grant to provide baseline information on the concentrations of fluorochemicals in Minnesota waters and determine the presence of spatial variability. He will also investigate the relative importance of various sources such as atmospheric deposition, and sediments versus water column transport.

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environmental community on what indicators are their best bets for future monitoring efforts,” said Niemi. “The EPA has provided a wonderful opportunity to critically examine which indicators can be used to determine the health of the US Great Lakes coastal and near shore regions.”

Niemi and his team will compile and rigorously test what they consider to be the best and most comprehensive of existing and new indicators. Over 80

indicators identified by EPA will be evaluated in this project. An important goal of the project is to link indicators with specific stressors to allow managers to more easily determine causes of impairment discovered during monitoring. Research will be divided among five major components: fish and macroinvertebrates; diatoms and water quality; wetland vegetation; birds and amphibians; and chemical contaminants. Various scientists from around the Great Lakes will lead each component, and Niemi will head project management with Ronald Regal, (UMD, Mathematics and Statistics), George Host (CWE), Carl Richards (Minnesota Sea Grant), and David Mladenoff (University of Wisconsin).

Fish and macroinvertebrates

Fish and macroinvertebrates have been used extensively as indicators in streams and rivers. The examination of these two communities will be valuable because they respond to stressors at different time scales and integrate ecosystem-level responses such as primary and secondary production, nutrient cycling,

and predator prey relationships. Lucinda Johnson (CWE) will lead this study, with cooperation from Carl Richards (Minnesota Sea Grant), and Jan Ciborowski (University of Windsor).

Diatoms and water quality

Diatom algae are abundant and diverse in all Great Lakes aquatic systems and are known to integrate stressor information with great fidelity. Diatom community responses are closely linked to water quality, especially chemical disturbances from nutrients, salinity, sediments, and acidification. John Kingston (CWE) will direct the diatom research, with Richard Axler (CWE) providing water quality expertise. Eugene Stoermer (University of Michigan), and Jeffrey Johansen and

Gerald Sgro (John Carroll University) will also collaborate on this portion of the project.

Wetland vegetation

Coastal wetland ecosystems are among the most severely impacted areas of the Great Lakes basin. Carol Johnston (CWE) will lead the study of vegetative indicators of coastal wetland condition. Wetland plants form the underpinnings of the habitat structure while also influencing water quality. Joy Zedler (University of Wisconsin) and Barbara Bedford (Cornell University) will also be working on the project.

Birds and amphibians

Breeding bird diversity in the US and Canada is highest in the Great Lakes basin, and breeding success is directly related to aquatic habitat, land cover types, and landscape characteristics.

Because amphibians spend their lives at the interface of aquatic and terrestrial systems, they also are ideally suited for use as indicators of land use and landscape change. Robert Howe (University of Wisconsin) and JoAnn Hanowski (CWE) will be working on bird and amphibian indicators of Great Lakes shoreline condition. Charles Smith (Cornell University) will be a cooperator.

Contaminants

Deborah Swackhamer, with Matt Simcik (UM, Environmental and Occupational Health), will head the study of contaminants. Contaminants, specifically polyaromatic hydrocarbons (PAHs) and endocrine disruptors, deserve special consideration because of their importance, and because of the magnitude of the contaminant problems that exist in the Great Lakes. Contaminant problems place stress on benthic invertebrates, fish communities, nesting birds, amphibians, and fish-eating mammals.

Information dissemination

The Minnesota Sea Grant Program will work with other Sea Grant managers across the Great Lakes to disseminate information to the public and management agencies.

The Great Lakes basin, spanning two countries, eight states and one province, contains approximately 18 percent of the

world’s surface fresh water. In order to develop the sound science required to monitor priority areas, EPA developed the Estuarine and Great Lakes (EaGLe) initiative within the STAR program. This grant is the first being awarded to four focus areas that

include the Great Lakes, Atlantic Coast, Pacific Coast and Gulf Coast. Study sites for this particular project will span the US portion of the 200,000-square-mile Great Lakes basin.

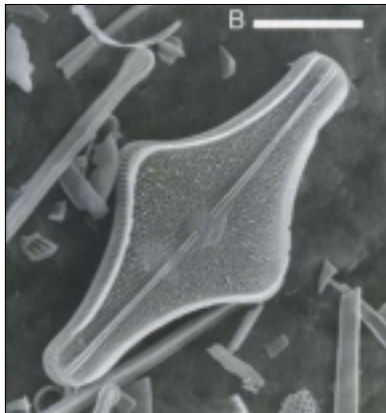


Photo courtesy of NRRRI
Diatom *Brachysira follis* (an algae) as seen using a scanning electron microscope (scale bar = 10 μm).



Photo courtesy of Patrick Brezonik



Minnesota Water Community News

Charlie Blinn (Forest Resources) won the Technical Writing Award from the Forest Resources Association's Lake States Technical Division for his technical release, "Reusable Temporary Stream and Wetland Crossing Options." The 125-page publication describes a variety of options that loggers and landowners can use to minimize damage to streams and wetlands during a timber harvest.

Doug Schnurrenberger (Limnological Research Center) and **Jim Russell** (Ecology, Evolution, and Behavior) traveled to Yemen in March with French and German scientists to collect long lake cores from Bir ali, a lake located on the Arabian Peninsula. **Russanne Low** (Limnological Research Center) collected short cores from this lake last summer. The Arabian Peninsula is considered a "blank spot" in the global paleoclimatic record (few lakes exist there and they have not been cored yet). The group hopes to fill this gap with information gained by examination of the long cores. **Schnurrenberger** also will travel to South America in April as National Lacustrine Core Repository curator to assist with the collection of lake cores from Lake Titicaca in Bolivia.

Patrick Brezonik (Water Resources Center, Civil Engineering), **Paul Bloom**, and **Ed Nater** (Soil, Water, and Climate) are organizing a special session on chemical transformations of mercury in aquatic and soil systems for the 221st National Meeting and Exposition of the American Chemical Society, to be held in Chicago in August. **Deborah Swackhamer** (Environmental and Occupational Health) is organizing a special session on emerging pollution issues in the Great Lakes for this meeting.

Mary Renwick (Water Resources

Center) will present "California's Budding Market: An Analysis of Willingness-to-Pay and Accept Compensation" at the 7th Conference of the International Water and Resource Economics Consortium and 4th Seminar on Environmental and Resource Economics in Girona, Spain on June 3-5.

Ken Brooks (Forest Resources) and **Heinz Stefan** (Civil Engineering) recently received University of Minnesota Distinguished Teaching Awards. These awards recognize contributions to postbaccalaureate, graduate, and professional education through excellence in instruction; involvement of students in research, scholarship, and professional development; development of instructional programs; and advising and mentoring students.

Jim Perry (Fisheries, Wildlife, and Conservation Biology) received an Award of Merit from the Minnesota chapter of Gamma Sigma Delta, the Honor Society of Agriculture. The award recognizes Perry's outstanding service to agriculture and the related sciences and arts.

George Spangler (Fisheries, Wildlife, and Conservation Biology) recently received an Award of Excellence and a Distinguished Service Award from the North Central Division of the American Fisheries Society.

Anne Kapuscinski (Fisheries, Wildlife, and Conservation Biology) recently won the Pew Marine Conservation Fellow Award for her project, "Safety Governance of Marine GMOs." This award is regarded by the scientific community as the world's preeminent award for marine conservation.

Thomas Jabusch (Ph.D. student, Water Resources Science) was awarded a 2001 Graduate Student Award in Environmental

Chemistry from the American Chemical Society. Jabusch is advised by **Deborah Swackhamer** (Environmental and Occupational Health).

Stefanie Miklovic (M.S. student, Water Resources Science) recently was awarded the Alexander P. and Lydia Anderson Fellowship, and the Carolyn M. Crosby Fellowship from the University of Minnesota. Miklovic is advised by **Susan Galatowitsch** (Horticulture).

Edith Mussukuya-Kerre (M.S. student, Water Resources Science) received a fellowship from GIWA for study in southern Africa. Mussukuya-Kerre is advised by **David Mulla** (Soil, Water, and Climate).

Brian Huser (Ph.D. student, Water Resources Science) received a Fulbright-Hays grant for study in Sweden. Huser is advised by **Patrick Brezonik** (Water Resources Center, Civil Engineering).

Jay Peterson has been awarded a Torske Klubben Fellowship for the 2001-2002 academic year. Peterson is advised by **Meng Zhou** (Physics, Large Lakes Observatory, UMD).

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payment of utility bills. Small community systems often have difficulty collecting bills that are past due because they do not have ordinances in place providing operational guidelines. Longfellow provided copies of model ordinances, available through the League of Minnesota Cities, for securing utility charges. One clear theme of the workshop was the importance of advance planning and good communication with the public.

For more information, contact Mary Renwick (WRC) at (612) 625-9798 or E-mail: renwi001@umn.edu.



Upcoming Events

May 3-5. **Minnesota Lakes and Rivers Conference.** Brainerd, MN. This conference, co-sponsored by the Minnesota Lakes Association, the Rivers Council of Minnesota, state agencies, the Water Resources Center, and the Minnesota Sea Grant Program, will blend professional and public topics, including updates on exotics, cumulative impacts of development, building sustainable organizations, mercury in the environment, aquatic plant management, water management in Minnesota, lake inventory tools, and more. For more information, contact the Minnesota Lakes Association at (800) 515-LAKE or E-mail: LAKES@mnlakesassn.org.

May 17-18. **Aquatic Nuisance Species Symposium.** Ann Arbor, MI. This symposium, entitled "Looking Back, Looking Forward: Assessing ANS Prevention and Control" will explore the steps needed to advance ANS prevention and control in the Great Lakes-St. Lawrence region. Special focus will be given to ballast water management, and other significant vectors of ANS introduction and spread. Contact Michael Donahue, Great Lakes Commission at (734) 665-9135.

May 7-8. **Effectively Communicated Health Risks from Fish Contaminants.** Chicago, IL. This national risk communication conference is sponsored by the US EPA and the Minnesota Department of Health. For more information, visit <http://www.fishrisk.com/>.

June 10-14. **44th Annual International Conference on Great Lakes Research.** Green Bay, WI. The IAGLR conference brings scientists and policy/decision makers together to present current research and information on various

Great Lakes topics to over 500 delegates from as many as 20 countries. The theme for the 2001 conference is "Great Lakes Science—Making it Relevant." For more information, visit the conference web site at <http://www.iaglr.org/conference/conference.html> or contact Victoria Harris at UW Sea Grant Institute at (920) 465-2795 or E-mail: harrisv@uwgb.edu.

July 11-13. **The Inaugural Conference of the United States Society for Ecological Economics.** Duluth, MN. The USSEE is the most recent Regional Chapter of the International Society for Ecological Economics (ISEE). Ecological Economics is an interdisciplinary field of study aimed at the design and implementation of socially and ecologically sustainable economic development. Conference themes will be the social and ecological dimensions of a sustainable and just global economy. This event will showcase the work of over 200 ecological economists representing academia, government agencies, non-profits and the business community. Visit the conferences website at <http://www.ussee.org/> for more information.

November 8-10. **Working Landscapes in the Midwest: Creating Sustainable Futures for Agriculture, Forestry, and Communities.** Delevan, WI. This Conference will explore practices and policies that promote land-based economic activity to sustain families, communities, and ecosystems, while also providing multiple benefits to society. Conference participants (including public and private stakeholders) will engage in group discussions to identify means for achieving long-term economically and environmentally sustainable action strategies and policy ideas. For more information, contact Marin Bryne, Institute for Agriculture and Trade Policy,

at (612) 870-3436 or E-mail: marin@iatp.org; Warren Flint, Five E's, at (202) 488-2707 or E-mail: rwflint@eeeeee.net; or Dave Carvey, NRCS, at (608) 224-3009 or E-mail: dcarvey@mw.nrcs.usda.gov.

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streamflow statistics had to measure the physical characteristics and insert them into the equations by hand, which can be tedious and time-consuming.

USGS hydrologists developed a set of 13 equations that can be used to estimate streamflow statistics for most streams in Massachusetts based on long-term records of flow from USGS streamgages. One of the equations can be used to estimate the 7-day, 10-year low flow, a statistic used by the US Environmental Protection Agency and state agencies for permitting of pollutant discharges. Another equation estimates the August median flow, used by the US Fish and Wildlife Service in New England as the minimum flow needed to protect aquatic animals and plants. At present, the website only provides low-flow statistics, but work is underway to incorporate flood statistics as well.

The method and the web page are described in a report and a fact sheet developed in a collaboration between USGS and MassGIS, the state geographic information agency, and the Massachusetts departments of Environmental Management and Environmental Protection. Both products are available at <http://ma.water.usgs.gov/streamstats/>.

USGS News Release



New Publications

Water: The Potential Consequences of Climate Variability and Change for the Water Resources of the United States.

2000. Water Sector Assessment Team of the National Assessment of the Potential Consequences of Climate Variability and Change for the US Global Change Research Program. This report evaluates the potential consequences of climate change for the water resources and systems of the United States. Available at <http://www.gcrio.org/nationalassessment/water/> or <http://www.pacinst.org/naw.html>.

ANS-HACCP: Aquatic Nuisance Species-Hazard Analysis and Critical Control Point Training Curriculum. 2000.

Minnesota Sea Grant. This course manual was adapted from a program developed by the National Seafood HACCP Alliance for Seafood Safety Training and Education, and is written especially for wild baitfish harvesters and fish farmers (both private and public) who raise baitfish or fish for stocking into public and private waters. The manual identifies pathways through which aquatic nuisance

species or non-target aquatic species could enter aquaculture and baitfish operations. It also identifies methods to prevent accidental transfer of these species to new areas. Available from MN Sea Grant at <http://www.seagrant.umn.edu/pubs/freeorder.html>.

A GreenPrint for Minnesota: State Plan for Environmental Education. 2001.

Minnesota Environmental Education Advisory Board and the Minnesota Office of Environmental Assistance. The GreenPrint (the state plan for environmental education) is designed to foster and expand partnerships to produce and provide environmental education programs and materials to Minnesota citizens. Implementation of the GreenPrint will increase environmental literacy and provide Minnesotans with the knowledge and skills to become active and engaged citizens to help keep our communities healthy and vital. Available at <http://www.seek.state.mn.us/>, or contact Sally Peterson at (651) 251-0286 or (800) 657-3843.

Minnesota Shoreland Management Resource Guide. 2000. This website is directed toward shoreland stewards who care about lakes and rivers, including property owners, resource managers, educators, and volunteers. It provides access to useful publications that are out of print or difficult to find, as well as new materials. Documents are formatted for easy on-screen viewing and most can be downloaded as high-quality print copies (PDF files). Leaders and resource managers will find in-depth technical information, and property owners will find detailed guidance for managing their shoreland. Visit <http://www.shorelandmanagement.org/>.

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