



North Dakota Water Resources Research Institute

North Dakota State University
University of North Dakota



Website: www.ndsu.edu/wrri

November 2005

NEWSLETTER

From the Director

Dr. Padmanabhan, during his six months of sabbatical in Thailand, taught a course “Hydrology in Watershed Management” to the students of a post-graduate program in Environmental and Hazardous Waste Management at the National Environmental Research Center, Chulalongkorn University, Bangkok, and also interacted with the Environmental Management program faculty at Prince Songkla University, Hat Yai. He also spent three months in India meeting water professionals and university faculty on water related issues.

Welcome to the 2005 issue of NDWRRI newsletter. I was on sabbatical last year and Dr. Wei Lin filled in for me as the Interim Director of the Institute. The 2004 fellowship research and accomplishments of institute faculty are highlighted in this issue. I encourage you to visit the Institute website, www.ndsu.edu/wrri for details. Notice the new look of the website. It is reorganized. Several links including a “ND WRRI Affiliate Faculty” is added.

As in the past few years, again this year, the Institute continued to meet its mission by dedicating most of the Federal allotment funds toward competitive graduate student research fellowships. The faculty advisors provide matching or co-funding for the research through the university, or grants from local, county, state or federal agencies, foundations, or industry. Once again, the Institute Advisory Committee consisting of representation from the three major water agencies – the State Health Department, the State Water Commission, and the U.S. Geological Survey – provided valuable help in setting Institute’s research priorities and reviewing Fellowship applications. The Institute co-sponsored an international conference on water with the International Water Institute, Fargo, ND and a biotic resources seminar program with the Department of Biological Sciences, North Dakota State University. The Institute-affiliated faculty and students working in water-related research were encouraged to participate in these events.

The Institute faired well in the 5-yr performance review by the US Geological Survey and National Institute of Water Resources review panel.

This year, the North Dakota State Water Commission appropriated \$13,860 to support the Fellowship program of the Institute. The Commission intends to continue the assistance at a level not exceeding 15% of the Institute’s annual base grant subject to year-by-year approval.

Two of the nine grant awards of the national competitive program of the USGS and National Institute of Water Resources were awarded this year to ND WRRI affiliate faculty.

G. Padmanabhan, Director
North Dakota Water Resources Research Institute
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Dr. Wei Lin has been named the Director of the Environmental and Conservation Sciences (ECS) graduate program at NDSU. Dr. Lin recently served as the Interim Director of the NDWRRI for a year, while the Director, G. Padmanabhan was on sabbatical.

Conferences and Seminars

Second Red River Basin International Conference on Water (April 6-7, 2005, Winnipeg, Canada)

NDWRRI sponsored the Second International Water Conference titled Research Education in an International Watershed: Implications for Decision Making. The conference organized by the Red River Basin Institute brought administrators, researchers, professionals and educators to Winnipeg, Manitoba, Canada to discuss water resources, flood control and water quality management issues related to the Red River basin.

NDSU Biotic Resources Seminar Program

NDWRRI continued its sponsorship of the Biotic Resources Seminar Series at North Dakota State University. Since 1987 it has brought about 70 biology-oriented speakers to the campus. Under this multi disciplinary program, experts are invited to speak on current research priorities and topics. Seminar topics range widely, with the common thread being organismal/environmental biology in the broadest sense.

2005-06 Institute Fellowship Awards and 2004-05 Fellowship Research Highlights

The Institute awarded nine Graduate Fellowships for the year 2005-06

- William Lenarz, University of North Dakota, “Effect of flow path processes on the geochemistry and quality of water discharged along the seepage face at Pigeon Point, Sheyenne Delta aquifer, Ransom County, North Dakota”
- Chistina Melaas, North Dakota State University, “Evaluation of an Index of Plant Community Integrity for Assessing Wetland Plant Communities in the Prairie Pothole Region”
- Michael Newbrey, North Dakota State University, “Evolution of Fish Growth and its Response to Climate”
- Jennifer Newbrey, North Dakota State University, “Effects of West Nile Virus Infection, Immune Function, and Age on Female Yellow-headed Blackbird”
- Dan McEwen, North Dakota State University, “Benthic macroinvertebrate stoichiometric implications for North Dakota and Minnesota fisheries”
- Ali Gene Tackett, North Dakota State University, “Molecular Phylogeography of *Etheostoma nigrum* (Rafinesque) in the Upper Midwest”
- Brajesh Gautam, North Dakota State University, “Analysis and Model Simulation of Storm Water Runoff - A Study of Land Use and System Design on Discharge and Water Quality”
- Tedros Tesfay, University of North Dakota, “Modeling Groundwater Denitrification by Ferrous Iron with PHREEQC”
- Kendall Goltz, North Dakota State University, “The Impact of Wetlands and Wetland Easements on North Dakota Land Values

2004-05 NDWRRRI Fellowship Research Highlights



Groundwater Denitrification Modeling

Investigation results of a denitrification research by Tedros Tesfay and James Spencer under the guidance of Dr. Scott Korom show that organic carbon and sulfide are active electron donors for denitrification in aquifers. It is also believed that ferrous iron is an active electron donor; however, the geochemical evidence for ferrous iron is more difficult to interpret. The computer software PHREEQC developed by the U.S. Geological Survey is used to gain a more comprehensive understanding of the hydrogeochemical environment that governs denitrification by ferrous iron and associated aquifer reactions.



Measurement of Red River Flow Using Acoustic Doppler Velocity Meter

In this project, the hydraulic factors that affect river flow velocity and their impact on the flow measurement are studied using an acoustic Doppler velocity meter (ADVM) by Brent Hanson under the direction of Dr. Wei Lin and Dr. G. Padmanabhan. Using the index velocity given by ADVM and an understanding of the effects of the hydraulic factors, a velocity rating curve will be developed. An improved rating curve can then be used to provide accurate discharge estimates over a wide range of flow conditions.



Storm Runoff Analysis and Modeling

Storm runoff from Fargo, ND and Moorhead, MN areas was identified as a major source of fecal coliform contamination in the Red River of North. As part of a Total Maximum Daily Load (TMDL) program, storm water flows were monitored for quantity and quality in selected drainage areas. Model simulations were carried out to determine the storm water discharge and fecal coliform load from each drainage area. Brajesh Gautam works on this project with guidance from Dr. Wei Lin.

Microbial Regrowth Potential in City Waters

Biodegradable organic matter in treated water can induce the growth or regrowth of microorganisms in distribution systems of drinking water. The goal of this fellowship project is to examine the regrowth potential in Fargo, ND and Moorhead, MN waters by measuring the concentrations of biodegradable dissolved organic carbon (BDOC) and assimilable organic carbon. Trent Museus works with Dr. Eakalak Khan on this project.



Kinetic Study and Modeling of Ammonia Removal



A full scale moving bed biofilm reactor (MBBR) was built recently in the Moorhead, MN wastewater treatment plant to meet ammonia removal requirements before discharging the effluent to the Red River. A better understanding of key parameters that affect the performance of this new process is necessary to provide proper operational control, operator training and information for improving future designs. The objectives of this project include (1) monitoring the system operation under various conditions, and (2) develop a kinetic model to simulate the performance of the system. Lynne Seth works with Dr. Wei Lin on this project.

Immunological impact of West Nile Virus (WNV) on native North Dakota wetland species



Because stagnant water in wetlands is ideal breeding habitat for mosquitoes, wildlife associated with these habitats may suffer high rates of WNV infection. This necessitates a study of the prevalence and immunological impact of WNV on native North Dakota wetland species. This study will provide essential information on the prevalence and immunological impact of WNV on a North American avian species. By testing for the presence of antibodies to WNV in yellow-headed blackbirds, the vulnerability and degree of virus exposure in a free-living population of wetland dwelling birds is assessed. One will also be able to evaluate potential influences of current high-water conditions on breeding populations of mosquitoes and avian WNV infection rates. Jennifer Newbrey works with Dr. Wendy Reed on this project.

Response of Pleistocene Fish to Climate Change



To study fish species colonization and the response of populations to climate change, Michael Newbrey and his dissertation advisor Dr. Allan Ashworth reexamined a well preserved late Pleistocene to early Holocene fossil fish assemblage from lake deposits on the Missouri Coteau, North Dakota. The sequence of colonization is explained by individual thermal and relative water velocity tolerances for each species. This study provides insight into the complex effects of a changing climate on fish populations and demonstrates the potential of using fossils to examine the long-term abundance patterns of contemporary fish species.

NDWRRI faculty wins awards to study water issues in North Dakota and Minnesota

WRRI faculty received two out of eight grants awarded this year nationally in a competitive program administered by the USGS and National Institute of Water Resources to study water issues in North Dakota and Minnesota.

- Robert Hearne, Assistant Professor, Agribusiness and Applied Economics, North Dakota State University, “Assessing the Effectiveness of Local Water Institutions in Water Quality Protection”
- Steven Shultz, Associate Professor, Natural Resource Economics and Jay Leitch, Professor, college of Business Administration, North Dakota State University, “The Impact of Rural Water Supply Systems on Property Values”

Hearne’s study will focus on the Red River Basin in Minnesota and North Dakota, examining how governmental and non-governmental institutions effectively resolve water issues. The basin has to deal with three different sets of water law. Schultz and Leitch will estimate the impacts of three recent and pending rural water supply systems on agricultural and rural-residential property values across North Dakota.

NDWRRI researcher wins CAREER award from National Science Foundation

Eakalak Khan, Assistant Professor in Civil Engineering and an institute faculty, received the Faculty Early Career Development (CAREER) Award from the Bioengineering and Environmental Systems Division of National Science Foundation in support of a five-year project "Integrated Interdisciplinary Nanotechnology Research and Education on Fundamentals and Applications of Cell Entrapment for Water Pollution Control" to study the effects of entrapment on cell characteristics and activities of microbial cultures typically encountered in wastewater treatment systems using molecular biology and nanoscopic techniques. The goal of Khan’s research is to advance fundamental understanding on the use of cell entrapment in wastewater treatment. Khan will investigate the effects of entrapped bacteria on growth rate, metabolic activity, cell morphology, cell surface properties, genetic material quantity and stress of three pure cultures encountered in activated sludge. Techniques in molecular biology and nanotechnology will be used to determine what lies beneath the performance of trapped cells. Khan joined the faculty at NDSU in 2002. He received his Ph.D. from the University of California, Los Angeles in 1997. He has two master’s degrees, one from UCLA and the other from University of Hawaii.

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(L to R) Mike Sauer (NDSHD), Fellow Michael Newbrey, G. Padmanabhan (Director), Fellow Jennifer Newbrey, Greg Wiche (USGS), Douglas Emerson (USGS) and Wei Lin (NDSU) at the advisory committee meeting in Bismarck. Bill Schuh (SWC) missed the photo op.

USGS / National Institute of Water Resources National Competitive Grant Program Request for Proposal

The Request for Proposals for the FY 2006 National Competitive Grants Program authorized by section 104G of the Water Resources Research Act of 1984 has been released. The RFP may be obtained either by going to <https://niwr.org/> and clicking on "View the RFP" under "National Competitive Grants Program". The research priorities for FY 2006 differ only slightly from those of last year. Proposals are sought in not only the physical dimensions of supply and demand, but also quality trends in raw water supplies, the role of economics and institutions in water supply and demand, institutional arrangements for tracking and reporting water supply and availability, and institutional arrangements for coping with extreme hydrologic conditions. The amount available for research under this program is estimated to be \$920,000 in federal funds. Any investigator at an institution of higher learning in the United States is eligible to apply for a grant through a Water Research Institute or Center established under the provisions of the Water Resources Research Act of 1984, as amended. Proposals involving substantial collaboration between the USGS and university scientists are encouraged. Proposals may be for projects of 1 to 3 years in duration and may request up to \$250,000 in federal funds. Successful applicants must match each dollar of the federal grant with one dollar from non-federal sources. Proposals must be filed on the Internet at <https://niwr.org/> by 5:00 PM, Eastern Standard Time, February 10, 2006 and must be approved for submission to the National Competitive Grants Program not later than 5:00 PM, Eastern Standard Time, February 24, 2006 by the Institute or Center through which they were submitted. Proposals may be filed on the website beginning November 1, 2005.

Researchers interested in submitting a proposal are requested to consult the Director of NDWRRI before submitting a proposal.

North Dakota Water Resources Research Institute (NDWRRI)

The Institute was founded in 1965 by authority of Congress as one of the 54 Institutes throughout the nation and is administered through the United States Geological Survey. The NDWRRI receives funding through section 104 of the *Water Resources Research Act of 1984* and it applies its Federal allotment funds to research that fosters: (A) the entry of new research scientists into the water resources field, (B) training and education of future water resources scientists, engineers, and technicians; (C) the preliminary exploration of new ideas that address water problems or expand understanding of water and water-related phenomena; and (D) the dissemination of research results to water managers and the public.