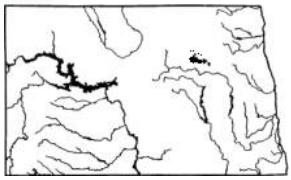
August 2007

North Dakota Water Resources Research Institute
North Dakota State University
Fargo, ND 58105



# Newsletter

The National Institutes for Water Resources

http://www.ndsu.edu/wrri

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## From the Director

Welcome to the 2007 issue of NDWRRI newsletter. In this issue, you will find the 2006 Fellowship and other research projects highlighted. You will also find research profiles of some Institute faculty. I encourage you to visit the Institute website, www.ndsu.edu/wrri or contact the respective Fellows, advisors, or principal investigators for details of research projects.

The Institute continued to meet its mission by dedicating, again this year, most of the Federal allotment funds toward the successful competitive graduate student research fellowships program. The Advisory Committee consisting of representation from 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.

Again this year, North Dakota State Water Commission continued its support to the Fellowship program of the Institute by appropriating $13,850.

The Institute co-sponsored a conference 'Research and Education in an International Watershed: Implications for Decision Making' with the International Water Institute, Fargo, North Dakota. Among many other research presentations of contemporary water-related issues, results from several WRRI Fellowship projects were presented at the conference by the student Fellows and advisors.

G. Padmanabhan, Director
North Dakota Water Resources Research Institute
Phone: 701 231 7043 e-mail: G.Padmanabhan@ndsu.edu

## Upcoming Events

September 30-October 5, 2007. **USCID Fourth International Conference on Irrigation and Drainage: Role of Irrigation and Drainage in a Sustainable Future.** Sacramento, CA (http://www.uscid.org)

October 23-24, 2007. **The Minnesota Water 2007 and Annual Water Resources Joint Conference.** Earle Brown Heritage Center in Brroklyn Center, MN (http://wrc.umn.edu/waterconf/

October 29-31, 2007. **Joint Conference: 2007 Eastern South Dakota Water Conference & 52nd Annual Midwest Groundwater Conference.** Sheraton Hotel and Convention Center, Sioux Falls, South Dakota (http://wri.sdstate.edu/esdwc/

November 7-9, 2007. **NWRA Annual Conference.** Hyatt Regency, Albuquerque (http://www.nwra.org)

November 12-15, 2007. **43rd AWRA Annual Water Resources Conference,** Embassy Suites Hotel, Albuquerque, NM (http://awra.org)

November 28-29, 2007. 2007 **Virginia / West Virginia Water Research Symposium, Connecting Management to aquatic Communities.** Blacksburg, VA (http:// www.vwrrc.vt.edu/2007Symposium.htm)

November 29-30, 2007. **52nd Annual New Mexico Water Conference, Beyond the Year of Water: Living Within our Water Limitations.** La Fanda, Santa Fe, NM (http://wrri.nmsu.edu/conf/conf07/conf.html)

# NDWRRI Co-Sponsors a Water Conference

NDWRRI co-sponsored the Third International Water Conference "Research Education in an International Watershed: Implications for Decision Making" in Grand Forks, North Dakota, in March 13-15, 2007. The conference organized by the International Water Institute brought administrators, researchers, professionals and educators to Grand Forks, North Dakota to discuss water resources, flood control and water quality management issues related to the Red River of the North. WRRI worked with the IWI in the planning and organization of the conference. The WRRI Director developed and chaired two sessions in the conference which provided a forum for presentation of the WRRI Fellowship research to the public. Several WRRI Fellows and their advisors participated. Ten past and present WRRI Fellows and three institute research faculty made presentations at the conference. The Institute affiliate faculty chaired three sessions in all:

Concurrent Session 4C: **Water Quality in Rivers and Streams**

*Moderated by **G. Padmanabhan**, Director, ND Water Resources Research Institute, North Dakota State University, Fargo, ND.*

1. **Upper Souris River TMDL Background Study.** *Wei Lin, Civil Engineering and Environmental and Conservation Sciences, Bernhardt Saini-Eidukat, Geosciences and Environmental and Conservation Sciences, Joseph Super, Environmental and Conservation Sciences, North Dakota State University, Fargo, ND, and Michael Ell, Environmental Administrator, North Dakota Department of Health, Bismarck, ND.*

2. **Simulation of Constituent Transport in the Red River of the North Basin, North Dakota and Minnesota, During Unsteady-Flow Conditions, 1977 and 2003-04.** *R.A. Nustad, Environmental Engineer, USGS, North Dakota Water Science Center, Grand Forks, ND, and J.D. Bales, Hydrologist, USGS, North Carolina Water Science Center, Raleigh, NC*

. 3. **Application of Entrapped Cell Systems for Treatment of Anaerobic Sludge Digester Supernatant.** *Christopher Hill and Eakalak Khan, Associate Professor, Department of Civil Engineering and Construction, North Dakota State University, Fargo, ND.*

Concurrent Session 6A: **Soils, Bacteria and Wastewater Treatment.**

*Moderated by **G. Padmanabhan**, Director, ND Water Resources Research Institute, North Dakota State University, Fargo, ND.*

1. **The Fate of Manure-borne, Land-Applied Hormones.** *Francis Casey, Associate Professor, Mary Schuh, graduate student, Dept. of Soil Science, Gerald L. Larsen, Research Chemist/Research Leader, Heldur Hakk, Research Chemist, Bioscience Research Lab, USDA-ARS, Fargo, ND, Zhaosheng Fan, graduate student, Dept. of Soil Science, North Dakota State University, Fargo, ND.*

2. **Denitrification in the Red River Basin and Beyond: How Aquifer Sediments Influence Water Quality.** *Scott F. Korom, Associate Professor, Department of Geology and Geological Engineering, University of North Dakota, Grand Forks, ND.*

3. **Sensitive Determinatrion of Bacterial Cells Using Fluorescent Nanoparticles.** *Yuhui Jin, graduate student, Dept. of Chemistry, Jenna Parisien, student, Dept of Chemistry, Min Wu, Assistant Professor, Dept. of Biochemistry, School of Medicine and Health, and Julia Xiaojun Zhao, Associate Professor, Dept. of Chemistry, University of North Dakota, Grand Forks, ND.*

Concurrent Session 6C: **Flood, Droughts and Water Management.**

*Moderated by **Phil Gerla**, Professor, Department of Geology and Geological Engineering, University of North Dakota, Grand Forks, ND.*

1. **Characteristics of Effective Local Water Management Organizations in the Red River Basin.** *Craig C. Kritsky, graduate student and Robert R. Hearn, Assistant Professor, Department of Agribusiness and applied Economics, North Dakota State University, Fargo, ND*

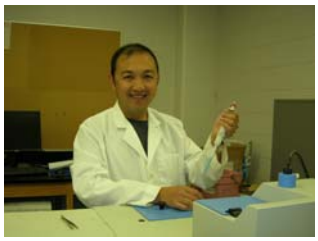
2. **The Red River Management Consortium.** *Daniel J. Stepan, Senior Research Manager, Energy & Environment Research Center, University of North Dakota, Grand Forks, ND.*

The presentations by the Fellows and Institute affiliate faculty can be viewed at the International Water Institute's web site:

http://www.internationalwaterinstitute.org/2007proceed.htm

# The Institute awarded Eleven Graduate Fellowships for the year 2007-2008

Fellow: William Clark
Adviser: Mark Clark, Biological Sciences, North Dakota State University
Title: "The examination of Life History Variation in White Sucker (Catostomus commersoni) Populations in North Dakota and Minnesota Drainages"



Fellow: Yuhui Jin
Adviser: Julia Zhao,Chemistry, University of North Dakota
Title: "Rapid and Sensitive Determination of Bacteria in Water Using Nanoparticles"

Fellow: Ryan Klapperich,
Adviser: Scott Korom, Geology and Geological Engineering, University of North Dakota
Title: "Analysis of Associated Bedrock-Aquifer System Sediments: Origins of Electron Donor-Rich Aquifers in Eastern North Dakota"

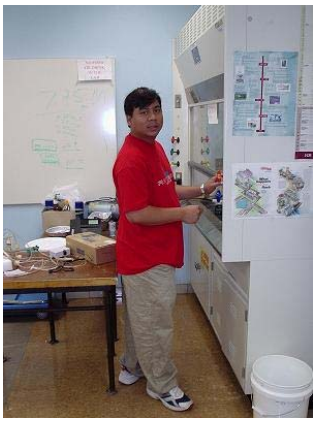
Fellow: Damion Knudsen
Adviser: Bernhart Saini-Eidukat, Geosciences, North Dakota State University
Title: "An Investigation into Subsurface Sampling and Characterization Efficiency Using a High Resolution GIS Based Earth System"

Fellow: Sita Krajangpan
Adviser: Achintya Bezbaruah, Civil Engineering, North Dakota State University
Title: "Effective Delivery of Iron Nanoparticles by Amphipilic Vehicles for Groundwater Remediation"

Fellow: Wei Zheng
Adviser: Malcolm Butler, Zoology, North Dakota State University
Title: "Classification of Macroinvertebrate Communities across Red River Drainage Basin"

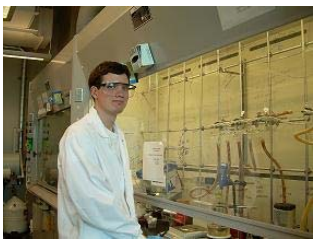
Fellow: Dan McEwen
Adviser: Malcolm Butler, Biological, North Dakota State University
Title: "Stoichiometry and the transfer of mercury from benthic macroinvertebrates into game fish "

Fellow: Breanna Paradeis
Adviser: Donald Kirby, Natural Resource Science
Title: "Plant Species Composition of Wetlands Locted in Restored Native Prairie"



Fellow: Thunyalux Rapukdi
Adviser: Eakalak Khan, Civil Engineering, North Dakota State University
Title: "Fractionation of Natural Organic Matter in Water from the Red River and the Moorhead Water Treatment Plant, Minnesota Using a Novel Solid Phase Extraction Technique"

Fellow: Mary Schuh
Adviser: Frank Casey, Soil Physics, North Dakota State University
Title: "Farm-scale reconnaissance of estrogens in subsurface waters"



Fellow: Jay M. Thompson
Adviser: Achintya Bezbaruah, Civil Engineering, North Dakota State University
Title: "Iron Nanoparticles for the Treatment of the Herbicides Atrazine, Alachlor and Dicamba in Groundwater"

# 2006-07 NDWRRI Fellowship Research Highlights

### Fellow Kendall Goltz

*The Impact of Wetlands and Wetland Easements on North Dakota Land Values*

Wetlands are ubiquitous across the Prairie Pothole region of North and South Dakota and Minnesota and numerous federal, state, and non-governmental agencies are actively involved in purchasing wetland conservation easements from private landowners. Common examples are the Small Wetland Acquisition Program of the United States Fish and Wildlife Service (USFWS), the Wetlands Reserve Program (WRP), and the Natural Resource Conservation Service (NRCS). To ensure that such programs are effective in encouraging landowners to place wetlands under easement while minimizing the expenditure of public funds, it is necessary that the impact of both wetlands and wetland easements on land values be fully understood. In this study Kendall Goltz and his advisor Dr. Jay Leitch investigate the impact. A total of 210 land purchasers that reside either in one of the larger North Dakota cities or outside the state were identified as potential recreational land buyers. Survey information about the nature of the sale was obtained from 152 of the 210 land purchasers. These estimates are expected to be used by the USFWS, the USDA-NRCS, rural appraisers, land owners, and land buyers/sellers to evaluate fair market prices for land purchases with and without different types of wetlands.

### Fellow Christopher Hill

*Using Entrapped Cell Systems for Treating Supernatant from Anaerobic Digester of the Moorhead Wastewater Treatment Plant*

In this study Christopher Hill and his advisor Dr. Eakalak Khan investigate the use of entrapped cells to treat supernatant from Moorhead City Wastewater Treatment Plant sludge digesters. Cell entrapment is a process which has been applied to domestic wastewater for the removal of both organic carbon and nitrogen. This is the first study to apply the cell entrapment process to highly concentrated wastewater. The main focus of this research is on the removal of nitrogen from Moorhead Wastewater Treatment Plant supernatant. Typically nitrogen is removed through a series of biological processes, nitrification followed by denitrification. Entrapped cell systems can follow this conventional configuration or nitrification/denitrification can be performed in a single reactor. The oxygen diffusion limitation of the entrapment matrix creates an environment in which both nitrifying and denitrifying bacteria can coexist. Both conventional two-step and simultaneous nitrogen removal are investigated in this research.

### Fellow Yuhui Jin

*Rapid and Sensitive Determination of Bacteria in Water using Nanoparticles*

The rapid and sensitive determination of pathogenic bacteria is important in the fields of biotechnology, medical diagnosis, and water analysis. Currently, conventional methods either are low sensitive or require long detection time. A rapid and sensitive bacteria determination method is critically needed. Quantum dot (QD) is a novel nanomaterial that has attracted researchers' great interest due to its unique advantage, which is simultaneously giving different emission wavelengths based on varying sizes when a single excitation source is used. However, quantum dots are restricted by their low quantum yield that results in limited signals when they are used as luminescent labeling materials. Meanwhile, most of QDs are toxic to living systems which limits their applications in biological and medical fields. Luminescent silica nanoparticle containing high quantum yields of organic dye molecules emits much stronger fluorescent signals than QDs, which has been successfully used for trace amount of DNA detection and other biochemical analyses. However, luminescent nanoparticles can only emit within a fixed narrow range of wavelengths. In this project Yuhui Jin and his advisor Dr. Julia Zhao study silica based fluorescent nanoparticles as a novel labeling nanomaterial for simultaneous analysis of multiple biomolecules, especially for labeling cells.

### Fellow Ryan Klapperich

*Analysis of Associated Bedrock-Aquifer System Sediments: Origins of Electron Donor-Rich Aquifers in Eastern North Dakota*

Nitrate pollution has long been recognized as the most prevalent form of groundwater pollution. The only effective process to remediate nitrate contaminants is denitrification, typically through natural attenuation. This process reduces nitrate ($NO_3^-$) to harmless nitrogen gas. The process occurs naturally, requiring only an oxygen-limited environment, the presence of nitrogen digesting bacteria, and the availability of electron donors. The three most common electron donors are organic carbon, sulfide (typically as pyrite, $FeS_2$), and ferrous iron minerals. Research has also shown that the controlling factor in this reaction has typically been the availability of suitable electron donors within the aquifer sediments. In this study, Ryan Klapperich and his advisor Dr. Scott Korom will investigate the link between the denitrification capacities of eastern North Dakota aquifers with the electron donor composition of the surrounding bedrock. If such a link is possible, a qualitative index (low, medium, and high) of aquifer denitrification capacity based on the probable source of the parent material will be developed. This index could then be used to focus, in a cost-effective fashion, more extensive and expensive geochemical analysis on specific aquifers or zones in specific aquifers.

### Fellow Melissa Konsti

*Top-down and Bottom-up Effects on the Abundance of periphyton in Shallow Lakes*

Shallow lakes are the most common lake type in North America, yet our ecological understanding of these systems is poor relative to deeper "sport fish" lakes. Throughout the Prairie Pothole Region (PPR), landscape alterations have directly and indirectly altered the character and quality of regional waterbodies. The ecological value of these shallow aquatic ecosystems decreases as conditions favor a turbid, phytoplankton-dominated condition with low abundance and diversity of invertebrates and submerged aquatic plants. Waterbodies in the turbid state are considerably less valuable to migrating waterfowl than clear-water, plant-dominated systems. Much evidence points to nutrients as a cause of high periphyton biomass, just as nutrient loading enhances planktonic algae. Fish presence in a shallow basin may also favor increased algae, both planktonic and periphytic. Periphyton is detrimental to macrophytes, and ultimately may contribute to a basin shifting from the clear-water state to the less valuable turbid state. We need to better understand what controls periphyton, and the role it may play in shifts from the clear-water state to the turbid-water state in shallow lakes within the PPR. Melissa Konsti and her advisor Dr. Malcolm Butler investigate this problem in this study.

### Fellow William Lenarz

*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, ND*

The large seepage face at Pigeon Point, Ransom County, North Dakota, provides an opportunity to trace the evolution of groundwater geochemistry back to its source as infiltrating precipitation. Previous work delineated pathlines and the capture zone in the groundwater flow system, which extends several kilometers upgradient. The contrasting land cover within the spring and seep capture zone consists of dunes, native grass pasture, wetland, and irrigated cropland that lie above the phreatic Sheyenne delta aquifer. Previous work revealed that the seepage face shows a wide variation in mineralization and oxidation-reduction conditions, with strikingly more reduced and mineralized water discharging from higher areas indicating a shorter groundwater pathline. William Lenarz and his advisor Dr. Philip Gerla hypothesize that the groundwater quality relates to vadose and shallow phreatic geochemical processes, which are largely controlled by differences in soils and land cover, and that water composition remains generally unchanged along deeper pathlines. Although the variation of geochemical composition of groundwater on a regional basis is generally understood, much less is known about the detailed, local processes that lead to the spatial variation of groundwater chemistry along a flowline. The groundwater flow system at Pigeon Point is well constrained physically, and shows remarkable variation across the seepage face.

### Fellow Dan McEwen

*Stoichiometry and the Transfer of Mercury from Benthic Macroinvertebrates into Game Fish*

Mercury (Hg) damages the central nervous system, altering the way that nerves conduct electrical impulses and divide, leading to lowered cognitive and metal functioning or in especially acute circumstances cerebral palsy, mental retardation or death. Hg emissions have continued to increase since the industrial revolution, entering aquatic food chains via atmospheric precipitation where they suspend in the water column and are taken up by phytoplankton or settle to the bottom where they become available to bacteria. Phytoplankton, with acquired Hg, is either ingested by zooplankton or sinks to the substrate as detritus. In turn, detritus and bacteria provide a food source to macroinvertebrate benthic organisms (i.e., benthos) and bioaccumulation occurs up through trophic levels eventually to game fish that are consumed by humans. As a result, the EPA and various state agencies issue advisories for fish consumption where impairment occurs. In this research project Daniel McEwen and his advisor study the taxonomy, stoichiometry, and benthic-pelagic coupling in the context of benthic contribution to Hg accumulation to fisheries in Minnesota and North Dakota lakes along a trophic gradient from oligotrophic to eutrophic. The objectives of this study are to characterize the benthic community of lakes under a variety of nutrient regimes, to quantify the biomass of the constituent members of the benthic communities in those lakes, to quantify carbon, nitrogen, phosphorus, and mercury ratios for those communities as a whole, and to model how those ratios impact rates of mercury accumulation and concentrations in piscivorous game fish likely to inhabit those lakes (e.g., lake trout, walleye, smallmouth bass, northern pike, etc.)

### Fellow Mary Schuh

*Farm-Scale Reconnaissance of Estrogens in Subsurface Waters*

Estrogens are very potent endocrine disrupting chemicals and are naturally present in animal manures applied to the soil. In areas where there are concentrated animals, such as at confined feeding operations, there is increasing concern on both state and regional levels that hormones may be transported to surface water or to groundwater. Research has shown that parts per trillion 17ß-estradiol concentrations can cause male fish to express female characteristics. Humans are not as toxicologically sensitive to hormones compared to aquatic organisms, yet the amount of environmental exposure to hormones is still unknown. Because of this, the fate and transport of estrogens and quantification of estrogens introduced into the environment from animal operations is an important problem. Mary Schuh and her advisor Dr. Francis Casey investigate this problem. The objective of this project is to identify the causes of the unexpected detections of 17ß-estradiol in a particular site. The data obtained from this study will allow the mechanisms of 17ß-estradiol and its metabolites to be studied more effectively. It will help to connect the ongoing field and laboratory research on this subject, and it will help to assess the effectiveness of the natural restorative processes in the environment.

Fellow Michael Newbrey

*Comparative Study of Fossil and Extant Fish Growth: Including Analyses of Mean Annual Temperature in the Geologic Record*

It is important to consider the implications of climatic change on surface water resources in light of potential consequences of global warming. North Dakota boasts some of the best long-term data sets in the form of a fossil record to measure the effect of climatic warming on a single population of fish. Very little is known about growth and the life history characteristics of fish in the fossil record. Fossils can provide valuable information about growth of extinct forms of fish, thereby providing insight into their life histories and ecology. This research will provide insight for fishery biologists and wetland ecologists concerning the long-term response of contemporary fish growth in North Dakota given potential climatic changes. In this project Michael Newbrey and his advisor Allan Ashworth examine the relationships between age, growth, longevity, and climate on a geologic scale. The objectives of this study are to: 1). examine the age and growth patterns of fossil freshwater hiodontids, esocids, and the percid, *Perca flavescens* from all fossil localities known to produce these taxa in North America; and 2). quantify patterns of growth of extant hiodontids, esocids, and the percid, *Perca flavescens* from a range of latitudes and ambient mean annual temperatures (MAT) to understand the effects of MAT on fish growth; 3) contrast the growth patterns from fossil fish to that of extant populations to examine evolutionary patterns. The research so far has 1) correlated contemporary yellow perch (Perca flavescens), muskellunge (Esox masquinongy), northern pike (Esox lucius), chain pickerel (Esox niger), goldeye (Hiodon alosoides), growth to temperature, 2) showed that climatic events such as that at the Cretaceous / Tertiary boundary and the Early Eocene Thermal Maximum are coincident with evolutionary events, 3) showed the effects of climate change on fossil fish colonization, biogeography, and population trends of fishes.

Fellow Ali Tackett

*Molecular Phylogeography of Etheostoma nigrum (Rafinesque) in the Upper Midwest*

The geologic history and abundant potential study sites of the upper Midwest provide a unique opportunity for the assessment of spatial genetic diversity. The Johnny Darter, *Etheostoma nigrum* (Rafinesque), with its large range and abundant populations, is an excellent species to study to answer phylogeographic questions about North Dakota and Minnesota. In this study, Ali Tackett and her advisor Dr. Craig Stockwell will examine the genetic diversity of *E. nigrum* by using microsatellite PCR primers designed initially for other species of *Etheostoma* and recently optimized for *E. nigrum*. This information will provide not only the inferred gene flow among the darters but will also provide a baseline against which to evaluate gene flow for other fish species located in the same water bodies. For instance, many game fish are stocked and transferred within and among watersheds with no genetic monitoring. By studying a benthic fish with a small home range, it will be possible to uncover the phylogeographic structure among the various watersheds of the upper Midwest. In turn, this information can be used by managers for conserving genetic diversity within and among watersheds.

Fellow Tedros Ttesfay

*Modeling Groundwater Denitrification by Ferrous Iron Using PHREEQC*

Nitrate is one of the most common groundwater contaminants. Denitrification converts nitrate irreversibly into harmless nitrogen gas. It is a natural process that requires an anaerobic environment, denitrifying bacteria, and sufficient and reactive electron donating species. Tedros Tesfay and his adviser, Dr. Scott Korom use the PHREEQC model to gain a more comprehensive understanding of the hydrogeochemical environment that governs denitrification by ferrous iron and associated aquifer reactions. The major reasons that led to the ignorance of the role of Fe(II) in previous regional studies were two: 1) The fact that geochemical evidences for Fe(II)-supported denitrifcation is hard to comprehend and, 2) in the event where both inorganic carbon and Fe(III)-oxyhydroxides were precipitating, the role of Fe(II) was masked by that of the organic carbon. Therefore, two important measures were taken to tackle these problems. First, the abundance of Fe(II) and the minerals that host it were determined using multiple complementary analytical techniques: wet chemical extractions, x-ray diffraction and Mössbauer spectroscopy. The results of these analyses confirmed that the sites where pyrite and organic carbon did not seem to be dominant are found to be relatively rich in ferrous iron minerals. Fe(II)-supported denitrification has a significant role as a natural remediation process. Moreover, observation of the hydrochemical data of the ISMs also demonstrated that denitrification rates were higher for those sites with higher concentrations of electron donors and vice versa.

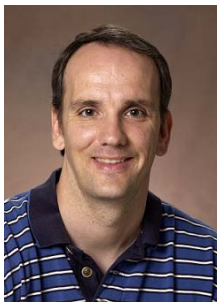
*Fellow Wei Zheng*

*Classification of Macroinvertebrate Communities across Red River Drainage Basin*

Aquatic macroinvertebrates living in large rivers generally use different habitats and respond differently to the hydrological regime. As one of the major rivers in western United States, the Red River of the North provides multiple uses for local people. However, little is known about the macroinvertebrate fauna of the Red, largely because rivers of this size and type are difficult to sample. The objectives of this research are to inventory the macroinvertebrate communities of different habitat conditions in the main stem Red River of the North and to explore the temporal changes of these benthic communities through the open water season. Wei Zheng and his advisor Dr. Malcolm Butler are looking into this problem in this study. Preliminary results from the drift nets, indicate that drift densities reached a maximum during summer, peaking in late August. Community composition differed between sampling sites and over time. Dominant taxa over the season included chironomid larvae, elmid beetle larvae, adults of several aquatic beetle families, as well as terrestrial Coleoptera. Chironomidae displayed the highest drift rates from August to early September, when other taxa were relatively sparse in the drift. The burrowing mayfly *Ephoron* (Polymitarcidae) had a notable emergence from mid-July to early August. Several drifting taxa (Chironomidae) were significantly negatively related to discharge, but not to other hydrological parameters. Seasonal variability in drift likely results from the life histories of individual species, as well as fluctuations in discharge. Terrestrial insects made a substantial contribution to invertebrate drift in this river reach.

# Featured Institute Researchers

*Francis Casey*



Growing up in the suburbs of New England, Dr. Frank Casey never thought he'd be living in Fargo, ND let alone being an Associate Professor of Soil Physics. His interests in earth sciences led to a Bachelor's degree in Natural Resources Management and Engineering at the University of Connecticut, and further led him to pursue his research interests in the prairies of the Mid-West. Dr. Casey earned both M.S. (1996) and Ph.D. (2000) degrees at Iowa State University in Soil Physics with an emphasis in Water Resources.

In February 2000, Dr. Casey joined the Department of Soil Science at NDSU. It's appropriate that Casey now lives in a state whose motto is "Strength from the Soil," which succinctly conveys that link between a healthy culture and a healthy land that supports that culture.

The primary research focus of Dr. Casey is the fate and transport of pollutants, and identifying agriculture's impacts (or lack of impact) on surface and subsurface water quality. His research is also both field and laboratory oriented. A major part of Dr. Casey's recent research is identifying the fate and transport of hormones and other bioactive chemicals in the environment. Some of these chemicals are naturally present in manures, and at trace concentrations these chemicals can induce endocrine disruption in sensitive organisms. Casey's research in this area has led to several grants and publications, in addition to him being recognized as an international expert in this area of research. He has also been honored with college and national early career awards for research.

Dr. Casey has equal enthusiasm for teaching. He believes that imparting the importance of soil and water resources is extremely important. He teaches *Soils and Pollution* and is developing curriculum for a new course, *Modeling Environmental Fate and Transport*. Additionally, Dr. Casey is involved with several education extracurricular and co-curricular activities that include Tribal School Sunday Academy, Expanding Your Horizons, Science Olympiad, Governor's School, Job Shadowing, and advising the Collegians for Life, and the NDSU Lacrosse Club. Dr. Casey also received an early career award for teaching from NDSU's College of Agriculture, Food Science, and Natural Resources.

Juila Zhao

Dr. Julia Xiaojun Zhao is an Assistant Professor in the Department of Chemistry at the University of North Dakota (UND). She is an analytical chemist who received her Ph.D. in 1999 from Jilin University in China. She was a postdoctoral research associate at the University of Florida before she joined the UND faculty in 2004. Dr. Zhao holds several patents and has published a number of research papers. Currently, Dr. Zhao's research group includes one postdoctoral research associate, four graduate students, and three undergraduate students. They are working on four research areas in the filed of nanoscience and nanotechnology.

Dr. Zhao's primary research focuses on the development of target-induced fluorescent nanoparticles for the determination of trace metal ions. The project is support by the National Science Foundation and the Society of Analytical Chemists of Pittsburgh (SACP) Start Award. Her group has developed several nanoparticles for sensitive and selective identification of selenium, zinc, and mercury.

The second focus of Dr. Zhao's research is to investigate toxicity of nanomaterials to living systems. This study in collaboration with Dr. Min Wu in the Medial School at UND is expected to provide critical information for biotechnological and biomedical applications of nanomaterials. Their recent publication on this work has been highlighted in the ACS (American Chemical Society) News Service Weekly PressPac.

The third research area of Dr. Zhao's group is to develop new types of fluorescent nanomaterials for simultaneous determination of multiple biological targets, primarily bacterial cells. Her graduate student, Yuhui Jin, a fellow of the North Dakota Water Resources Research Institute (NDWRRI), is currently working with several undergraduate students on this project. A group of quantum-dots-like fluorescent nanoparticles have been developed for the identification of multiple bacteria in water.

Dr. Zhao's group is also interested in the development of new nanocatalysts. With the funding support from the NDEPSCoR-DOE EPSCoR Infrastructure Improvement Program, Dr. Zhao and her collaborator, Dr. David T. Pierce at UND Chemistry Department, are developing silica-based metal nanocatalysts.

Dr. Zhao's research is funded by NSF, SACP, NDWRRI, NDEPSCoR, and UND.

Donald Kirby

Dr. Don Kirby is a professor and chair of the Department of Soil Science at North Dakota State University. Don came to NDSU in 1980 as an assistant professor in the Botany Department. He moved to the Department of Animal and Range Sciences in 1985 and has served as interim chairs of Veterinary and Microbiological Sciences (2000-2001), Animal and Range Sciences (2001-2003), Cereal and Food Sciences (2003-2005), and again Animal and Range Sciences (2005-2007). Don was appointed Chair of the Department of Soil Science this past July.

Dr. Kirby received B.S. degrees in Range Management and Wildlife Management in 1974 from Humboldt State University in 1974, and a master's degree in Natural Resource Management from Humboldt in 1976. He then work as a research technician for the Texas Agricultural Experiment Station as he pursued his Ph.D. Don received his Ph.D. in Range Science from Texas A&M University in 1980.

Dr Kirby's research interests include grazing management of rangeland, livestock:wildlife relations, noxious weed management, mined-land reclamation, and prairie wetland ecology. His involvement with the North Dakota Water Resources Research Institute (NDWRRI) focuses on assessment of the health of wetlands in the Prairie Pothole Region of the northern Great Plains. Don has had three students serving as fellows of the NDWRRI: Dr. Shawn DeKeyser (Ph.D., 2000), Christina Hargiss (M.S., 2005), and Breanna Paradeis (M.S., in progress).

## Recent Publications and Presentations by the Institute Fellows and Faculty

### *Publications*

**Jin, Y., Zhao, X.**, Wu, M. Determination of bacteria using luminescent nanoparticles, Pittcon 2006, Orlando, FL, March 2006

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**Philip J. Gerla, William Lenarz**. Effect of Land Cover and Pattern on the Quality of Groundwater Discharged from Spring and Seeps at Pigeon Point, Southeastern North Dakota. Technical Report No: ND07-01, **North Dakota Water Resources Research Institute**, 2007

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**Christopher B. Hall, Eakalak Khan**. A comparative Study of Immobilized Nitrifying and Denitrifying Bacteria for Ammonia Removal of Sludge Digester Supernatant. Technical Report No: ND07-03, **North Dakota Water Resources Research Institute**, 2007

**Michael G. Newbrey, Allan C. Ashworth**. Climate Change and Evolution of Growth in North American Hiodontidae, Esocidae, and Percidae. Technical Report No: ND07-04, **North Dakota Water Resources Research Institute**, 2007

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Christensen, V. G., 2007, nutrients, suspended Sediment, and pesticides in waters of the Red River the North Basin, Minnesota and North Dakota, 1990-2004. USGS Scientific investigations Report 2007-5065, 36 p. —URL http://pubs.er.usgs.gov/usgspubs/sir/sir20075065

Winterstein, T. A., 2007, Estimated groundwater use in Becker, Clay, Douglas, Grant, Ottertail, and Wilkin Counties, Minnesota for 2030-2050. USGS Scientific investigations Report 2007-5073, 31 p. —URL http://pubs.er.usgs.gov/usgspubs/sir/sir20075073

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# New USGS Map Locator

The USGS has launched a new web tool, USGS Map Locator and Downloader, designed to deliver topographic maps easier, faster and less expensively than before.

Using open source software and the Google Maps programming interface, the Map Locator and Downloader allows customers to find the topographic maps they need, by searching zip code, address, or navigating on an interactive map. Users can pan, zoom, change the map to see satellite imagery or a seamless USGS topographic map view, order printed maps or download a scanned map image in GeoPDF® format.

For more information on the Map Locator and Downloader visit

http://www.usgs.gov/newsroom/article.asp?ID=1718

# Sakakawea Master Plan and Master Manual

The U.S. Army Corps of Engineers, along with a steering committee made up of stakeholders, including non-governmental organizations and tribal, state, and federal agencies, continues to revise and update the Lake Sakakawea Master Plan. The master plan addresses land-based management of the lake.

A copy of the Draft (July 20, 2007) Lake Sakakawea Master Plan and Environmental Assessment is available at the Corps' website: https://www.nwo.usace.army.mil/html/Lake_Proj/garrison/MP/mpupdate.html

The master manual is the document that addresses how the lake level is managed. For viewing Missouri River Master Manual click: http://www.nwd-mr.usace.army.mil/mmanual/mast-man.htm

# Maple River Dam Dedication Held

Maple River Dam Ribbon Cutting Ceremony

The Cass County Joint Water Resource District sponsored a Maple River Dam dedication and ribbon cutting ceremony on July 17 at the dam site, located in southeast North Dakota, approximately eight miles northeast of Enderlin. Governor John Hoeven, members of the North Dakota State Water Commission, and several other dignitaries were present for the dedication. Maple River Dam is a 70-foot high earthen embankment, capable of temporarily retaining up to 60,000 acre-feet of floodwater. The dry dam is designed to provide flood protection along the Maple, Sheyenne, and Red Rivers."

Pipe outlet structure of Maple River dam under low flow conditions. Some of the WRRI Fellows along with hydrology course students from NDSU are taking a tour.

# Sovereign Land Management Plan

The Office of the State Engineer recently completed North Dakota's first Sovereign Land Management Plan. Sovereign land is another name for North Dakota's public lands in and around the state's major rivers and lakes. The plan includes 21 recommendations and corresponding action strategies that are aimed at improving management of the state's sovereign lands. Some of the management recommendations pertain to cultural and historic resources, water quality, motor vehicle use, littering, noxious weeds, hunting, boating, and camping. To view the document, click: http://www.swc.state.nd.us/4dlink9/4dcgi/GetContentPDF/PB-696/SovLandPlan.pdf

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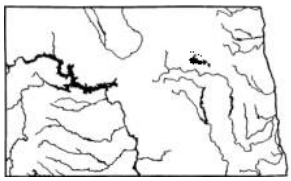

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WRRI Fellow Michael Newbrey in search of fossils

# 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.