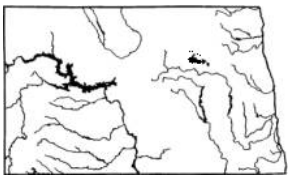
July 2008

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

Inside this issue:

From the Director

Welcome to the 2008 issue of NDWRRI newsletter. In this issue, you will find the 2007 Fellowship research projects and research profiles of selected Institute faculty highlighted. The 2008-09 Fellowship recipients and their projects are also included. 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.

Again in 2008, North Dakota State Water Commission continues its support to the Fellowship program of the Institute by matching 15% of the USGS annual base grant. The Institute continues to meet its mission by dedicating most of the Federal allotment funds toward competitive graduate student research fellowships. As in the previous years, the Advisory Committee consisting of representatives 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. Institute faculty and fellows presented the results of their research in several conferences and symposia. At the suggestion of the WRRI advisory committee, the ND WRRI Fellows and advisors from North Dakota State University and University of North Dakota presented their research in a "day of seminars" to water professionals at the Heritage Center auditorium in Bismarck on April 15. The event was videotaped and can be accessed via the web link http://swc.state.nd.us/4dlink9/4dcgi/redirect/index.html

Technical reports of several Fellowship projects are available on the Institute web site. It is also gratifying to note several Fellows graduated and moved on last year to accept responsible positions in various water-related areas of employment.

G. Padmanabhan, Director

Upcoming Events

- First International Nonrenewable Ground Water Resources Conference, 13-14 October 2008, in Portland, Oregon http://www.ngwa.org/DEVELOPMENT/conferences/details/0810135055.aspx

- Midwest Groundwater Conference, September 29-October 2, 2008, Grand River Center, Dubuque, Iowa http://www.igwa.org/2008MWGWC_Call_For_Abstracts.pdf

- 2008 American Water Resources Association (AWRA) Annual Water Resources Conference, November 17-20, 2008, in New Orleans, LA. http://www.awra.org

- 2009 AWRA Spring Specialty Conference: Managing Water Resources and Development in a Changing Climate, March 4-7, 2009, in Anchorage, Alaska.

- Managing Water in a Climate Changing World: Implications for Irrigation, Drainage, and Flood Control, A USCID Water Management Conference, Portland, Oregon, September 17-20, 2008. http://www.uscid.org

- The Minnesota 2008 Annual Water Resources Conference, River Center, St. Paul, MN, October 27-28, 2008. http://wrc.umn.edu/waterconf/

NDWRRI Sponsors a Day of Seminars in Bismarck

The North Dakota Water Resources Research Institute sponsored a day of seminars by WRRI Research Fellows and advisors at the North Dakota Heritage Center, Bismarck, on April 15th, 2008. The presentations can be viewed online or downloaded from the link:

http://www.swc.state.nd.us/4dlink9/4dcgi/redirect/index.html

The second text section down pertains to the WRRI seminars. Select "here" for a menu of talks.

The advisory committee of the Institute consisting of Bill Schuh of North Dakota State Water Commission, Gregg Wiche of US Geological Survey, and Mike Sauer of North Dakota Department of Health has been instrumental to host the event in Bismarck. There were twelve presentations attended by more than sixty water professionals.

Each year the Institute, supplemented by 15% match from the North Dakota State Water Commission, grants fellowships to graduate students at North Dakota universities for research in water-resource related areas on a competitive basis.

Standing (left to right): Mike Sauer (WRRI Advisory committee member), Sita Krajangpan (Fellow), William Schuh (WRRI ACM), Thunyalux Ratpakdi (F), Achintya Bezbaruah (Faculty Adviser), Eakalak Khan (FA), Jay Thompson (F), Edward Dekeyser(FA), Breanna Paradeis (F), Mary Schuh (F), Donald Kirby (FA), Harjyoti Kalita (F)

Sitting (left to right): Marinus Otte (FA), Dimuthu Wijeyaratne (F), Ryan klapperich (F), Scott Korom (FA), Rubiya Shabnam (F), Julia Zhao (FA), G. Padmanabhan (WRRI Director)

Phil Gerla (FA), Yuhui Jin (F), Damion Knudsen (F), and Gregg Wiche (WRRI ACM) could not join the group and missed the photo opportunity.

Plan to divert Missouri River water to Red River Valley

The government's preferred option to divert Missouri river water to the Red River Valley is on hold while diplomats try to resolve objections from Canadians. The proposal calls for transferring Missouri River water to Fargo and other cities in the valley to supplement water in times of severe, prolonged drought. The proposal awaits a Sept.1 target date for review by the U.S. Department of the Interior for selection. The U.S Secretary of the Interior, who oversees the Bureau of Reclamation, must sign off for the $660 million project to proceed. The preferred option would use existing irrigation canals built years ago for the abandoned Garrison Diversion Project and a pipeline to deliver water which will eventually flow into the Red River of the North. The Canadian government and the Province of Manitoba object strongly to any transfer of water from outside the basin to the Red River, which flows north into Hudson Bay, fearing the introduction of non-native plant and marine species.

Sen. Byron Dorgan has asked the federal officials to try to reach agreement with Canadian officials.

(Source: Fargo Forum, June 18, 2008)

The Institute Awarded Seven Graduate Fellowships for the Year 2008-2009

Fellow: Dimuthu Wijeyaratne

Adviser: Marinus Otte, Biological Sciences, North Dakota State University

Title: “Chemical Fingerprinting of Sediments and Water of the Souris River for Identification of Diffuse Pollution Sources”

Fellow: Rabiya Shabnam

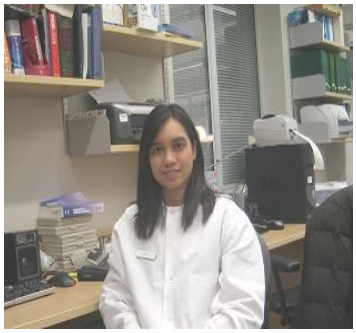
Adviser: Achintya Bezbaruah, Civil Engineering, North Dakota State University

Title: “Interactions between Microorganisms and Metal Nanoparticles: A New Approach for Groundwater Remediation”

Fellow: Harjyoti Kalita

Adviser: Achintya Bezbaruah, Civil Engineering, North Dakota State University and Bret Chisholm, Center for Nanoscale Science and Engineering, North Dakota University

Title: “Iron Imprinted Polymer for Removal and Monitoring of Arsenic”



Fellow: Sita Krajangpan

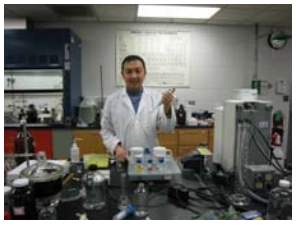
Adviser: Achintya Bezbaruah, Civil Engineering, North Dakota State University and Bret Chisholm, Center for Nanoscale and Engineering, North Dakota State University

Title: “Modification of Iron Nanoparticles by Amphiphilic Polysiloxane Graft CoPolymer for Arsenic, TCE and RDX Remediation”

Fellow: Jay Thompson

Adviser: Achintya Bezbaruah, Civil Engineering, North Dakota State University

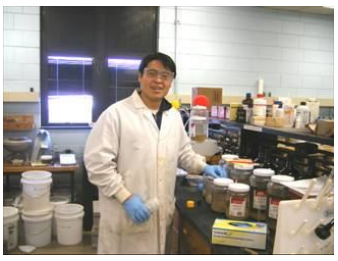
Title: “Selected Pesticide Remediation with Iron Nanoparticles: Modeling and Barrier Applications”



Fellow: Yuhui Jin

Adviser: Julia Zhao, Chemistry, University North Dakota

Title: “Rapid and Sensitive Determination of Bacteria in Water Using Nanoparticles ”



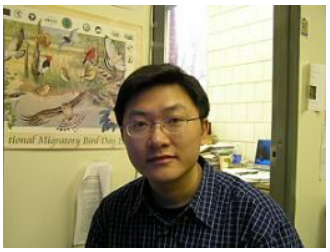
Fellow: Qigang Chang

Adviser: Wei Lin, Civil Engineering, North Dakota State University

Title: “Development of GACNZVI Adsorbent for Arsenic Removal”

2007-08 NDWRRI Fellowship Research Highlights

Fellow: Wei Zheng



This study is a survey of macroinvertebrate communities in major habitats of the main-stem Red River to assess the overall diversity of the invertebrate fauna and determine what types of animals predominate in diverse habitats within this river. The study also assesses a range of sampling techniques for monitoring this fauna. This information will be useful for comprehensive biological monitoring of the Red River main stem by multiple jurisdictions. Currently, no such synoptic, taxonomic list of the river's invertebrate fauna exists. The standardized and quantitative methods, along with stratification of discrete riverine habitats, will allow Wei to express the quantitative importance of all components of the fauna – including taxa of potential ecological significance that may have been neglected in previous surveys. By employing a range of sampling techniques, Wei and his adviser, Dr. Malcolm Butler will be able to judge the efficacy of different sampling methods for characterizing taxa that may be significant indicators of the river's function and condition.

Fellow: William Clark

William's research examines variation in individual growth (size at age, length-weight ratio, body lipid levels), reproductive effort (gonad: body mass ratio, age at maturation, tubercle development) and physiology (metabolic rate, immune function) in white sucker populations distributed in North Dakota and Minnesota. In addition, it will quantify relationships among watershed landcover, hydrology, and temperature and variation in white sucker life-history traits. As landscape alteration and the use of water resources continue, the ability to maintain sustainable aquatic ecosystems depends on an understanding of the relationships between individual organisms and their environment. The results from this study will demonstrate connections between resource allocation and environmental conditions. By understanding constraints regulating life-history traits via resource allocation at the individual level, biologists can better predict effects of habitat alteration on aquatic vertebrates. William's adviser is Dr. Mark Clark.

Fellow: Yuhui Jin

Bacteria can grow or re-grow in distribution systems of drinking water. The presence of even a single bacterium in potable water may pose a serious health risk. Therefore, sensitive and rapid detection of bacteria in water is critical. However, the current definitive method for the detection of bacteria is the culture of the organism, which requires about 24 hours for bacterial growth. The method is too slow to meet the public need. The PCR-based method can detect bacteria within 6 hours; but the method requires pre-enrichment of the target bacteria. Yuhui and his adviser, Dr. Julia Zhao, are working on a method using nanoparticles to specifically identify target pathogenic bacteria at a single bacterium level within 30 minutes in water samples. The method will be accurate, rapid and sensitive to meet the public need. In the first step, the quantum dot-like luminescent silica nanoparticles were developed. These luminescent silica nanoparticles can be excited by a single wavelength excitation source, and give out light with different emission wavelength. This property will benefit the simultaneously detection of different kind of bacteria targets. In the next step, lab-made bacteria samples are detected by these quantum dot-like luminescent silica nanoparticles. Next, samples colleted from North Dakota water system will be studied by using this method.

Fellow: Ryan Klapperich

The long-term goal of this research is to develop an aquifer nitrate vulnerability index based on the supply of electron donors in the aquifer sediments. Ryan's work specifically contributes toward that goal by considering the abundance of electron donors in the likely parent materials comprising the aquifer sediments. This research investigates the link between the denitrification capacities of eastern North Dakota aquifers with the electron donor composition of the surrounding bedrock. A qualitative index (low, medium, and high) of aquifer denitrification capacity based on the probable source of the parent material is developed. This index can be used to focus, in a cost-effective fashion, more extensive and expensive geochemical analysis on specific aquifers. Ryan's adviser is Dr. Scott Korom.

Fellow: Damion Knudsen

Damion's study characterizes directly-sensed groundwater contaminant data from Morton and McKenzie County, North Dakota, and a site in Codington County, South Dakota using modern geostatistical theory and geographic information systems. High resolution three dimensional models of subsurface contaminant distributions are created and computer simulations investigate different 3-D sampling densities to provide an optimized method or workflow for investigators. Damion and his adviser, Dr. Bernhart Saini-Eidukat, merge old and new technology for site characterization and management of three dimensional subsurface analyte distributions.

Fellow: Sita Krajangpan

Zero valent iron (Fe 0) nanoparticles (NZVI) have been used for groundwater remediation of various contaminants because of their unique physiochemical properties. Various chlorinated aliphatic hydrocarbons, explosive material, and arsenic have been successfully decontaminated by NZVI. However, NZVI are not only highly reactive with the contaminants, but also rapidly react with surrounding media in the subsurface (dissolved oxygen and/or water) and other non-target compounds. Thus, significant loss of NZVI reactivity occurs before the particles reach the target contaminant. In this study, Sita and her co-advisers, Dr. Achintya Bezbaruah and Dr. Bret Chisholm, investigate the degradation kinetics of TCE and As(III) by Amphiphilic polysiloxane graft copolymers (APGCs) coated NZVI and compare with kinetics data obtained with bare NZVI. For characterizing NZVI, Sita and her advisers use transmission electron microscopy (TEM), scanning electron microscopy with X-ray microanalysis (SEM/EDS), X-ray diffraction (XRD), and BET surface area analysis. APGCs are synthesized by hydrosilylation and characterized using nuclear magnetic resonance spectroscopy (NMR) and Fourier transform infrared spectroscopy (FTIR). Targeted delivery of the NZVI will save resources and time needed for remediation of contaminants in the subsurface.

Fellow: Dan McEwen

The North Dakota Department of Health currently has consumption advisories listed for Devils Lake, Red River, Lake Oahe, Missouri River, Lake Sakakawea, and other waterbodies due to concerns of mercury in Fish. Dan's research is on the dynamics of transference of mercury into a common fish prey item, Chironomus dilutus, under various nutrient regimes. This will help model the potential impact of mercury accumulation on fish feeding on these and similar invertebrates. This research will provide a better understanding of factors contributing to the bioaccumulation of mercury in aquatic ecosystems. Dan's adviser is Dr. Malcolm Butler.

Fellow: Breanna Paradeis

The goal of this study is to evaluate plant community composition and physical characteristics of prairie pothole wetlands in restored native prairie areas and to incorporate the data obtained into a model that predicts wetland condition and function based on environmental variables. Breanna's study compared and evaluated restoration and management techniques employed in restored native prairie areas, and their effect on the plant species composition, physical characteristics, and functional capacity of wetland ecosystems. This project also assessed the condition of wetland and upland plant communities in restored areas in order to relate the function of prairie pothole wetlands to environmental conditions. This project will provide valuable insight on the functional capacity of restored wetlands in various states throughout the region in order to evaluate restoration attempts and management techniques. Breanna's adviser is Dr. Don Kirby.

Fellow: Thunyalux (Tom) Ratpukdi

In the drinking water field, the presence of Natural organic matter (NOM) in the source water is a concern because it impacts the water quality and treatment processes. The main objective of Tom's study is to fractionate and characterize NOM from the Red River and to investigate the removal of each NOM fraction along the treatment train of MWTP. Recently, Tom and his adviser, Dr. Eakalak Khan, developed a new NOM fractionation procedure using prepacked solid phase extraction (SPE) sorbents to fractionate NOM into six fractions: hydrophobic acid, hydrophobic base, hydrophobic neutral, hydrophilic acid, hydrophilic base, and hydrophilic neutral. With this novel technique, the fractionation time could be reduced to about 6 hours (compared to 24 hours for existing technique). Tom used nuclear magnetic resonance (NMR) and Fourier transform infrared spectroscopy (FTIR) to characterize the isolated NOM fractions. For the first time, the application of the novel SPE technique is demonstrated and NOM in the Red River water fractionated. Deliverables from this project include the information on the composition and characteristics of NOM in the Red River water and the efficiency of treatment units at MWTP for removal of NOM fractions.

Fellow: Mary Schuh

In a previous study using lysimeters on a swine (*Sus scrofa*) farm to monitor the amount of 17ß-estradiol leaching through the soil of test plots treated with various types of manure, substantial amounts of 17ß-estradiol were detected at depths 60 cm and greater below the soil surface. Moreover, 17ß-estradiol was detected in the lysimeter leachate below the control plot where no manure was applied. Based on known application rates and laboratory-determined fate and transport parameters, it was anticipated that most of the 17ß-estradiol would be metabolized or bound to the top 10 cm of soil. In this study, Mary and her adviser, Dr. Francis Casey, identify the causes of the unexpectedly high 17ß-estradiol detections found in the lysimeters and also to assess the relationship between soil hydrology, including localized groundwater flow and vertical water movement within the soil profile, and the persistence and detections of 17ß-estradiol in the soil system. This project will provide valuable information on the behavior of 17ß-estradiol and its metabolites, allowing an assessment of the effectiveness of natural restorative processes in the environment. It will help to define the interaction of soil and ground water with respect to the retention and transport of 17ß-estradiol. Knowledge of these retention and transport processes may be useful in the development of remediation strategies. Furthermore, since 17ß-estradiol is a prototype for other endocrine disrupting chemicals (EDCs), results will contribute to a general understanding of EDCs and other possible organic contaminants.

Fellow: Jay Thompson

Pesticide contamination of groundwater remains an ongoing area of concern. One promising pesticide remediation technology is reductive dechlorination by iron filings or powder. This technology has been successful in both the lab and field. However, limitations inherent in this process have limited its use. Recent research has shown that nanoscale zero valent iron (NZVI), with its high surface area and reactivity, can overcome many of these limitations. Jay's research aims to determine the effectiveness of NZVI for the remediation of three commonly used pesticides, atrazine, alachlor and dicamba. This research, for the first time, comprehensively investigated the effect of iron nanoparticles on chloro-s-triazine, chloroacetanilide, and benzoic acid class herbicides. The results of this research will be useful for the development of a treatment system for herbicide removal from groundwater. Such a system could remediate herbicides present at a higher concentration than possible with biological processes. Jay's adviser is Dr. Achintya Bezbaruah.

Featured Institute Researchers

Craig Stockwell

Dr. Craig Stockwell has a passion for applying principles of evolutionary ecology to the management and conservation of native and exotic fish species. Historically managers have assumed that populations were evolutionarily static. However, work by Dr. Stockwell and his colleagues have shown that populations often evolve within years to a few decades. In fact, Dr. Stockwell and his students have documented three cases of such "contemporary evolution" for fish populations introduced to novel environments. A growing body of evidence suggest ecological functions and interactions are likely to be altered as populations evolve. These insights are now leading to paradigm shift calling for a evolutionarily en-lighted approach to the wildlife and fisheries management. For instance, invasive species often evolve as they invade new environments. Dr. Stockwell's students have also investigated the effects of non-native fish on the population biology of native fish species.

Most recently, Dr. Stockwell along with his graduate student, Ms. Ali Tackett, completed a study to evaluate the genetic structure of the Johnny Darter across three major drainages of the upper Midwest; the Red River of the North, the upper Missouri River and the upper Mississippi River. Many game and bait fish species have been transplanted within and among these basins, but Johnny darters have been less vulnerable to such transplants. Indeed, this NDWRRI supported genetic study showed strong genetic differences among basins and even between populations within basins. This work provides a baseline that can be used to evaluate the impacts of inter-basin water transfers on genetic diversity for aquatic organisms.

Dr. Stockwell's enthusiasm for conservation biology led him to play a significant role to design and initiate the graduate program in Environmental & Conservation Sciences. He also teaches courses in the areas of Conservation Biology and Wildlife and Fisheries Management. He has also served as Associate Editor of a major fisheries journal and has served on numerous scientific panels concerning the conservation of protected fish species.

Wendy Reed

Dr. Wendy Reed is an Assistant Professor in the Department of Biological Sciences at North Dakota State University (NDSU). She is a physiological ecologist. Dr. Reed has a Ph.D. from Iowa State University, Ames, Iowa. She was a postdoctoral scholar at Indiana University in Bloomington, Indiana before she joined the NDSU faculty. Currently Dr. Reed's research group includes one postdoctoral scholar, two graduate students and three undergraduate students. They are working on several research projects in the area of avian ecology, evolution and physiology.

Dr Reed's primary research focus is on the influence of maternal effects in determining offspring performance after hatching. She studies these effects in overwater-nesting birds, a group of vertebrates that rely on quality water resources and the large breeding aggregates of these birds can have a large impact on water quality. Female birds allocate a variety of resources including hormones, micronutrients and carotenoids all of which can have important impacts on the development of offspring immune function, behavior and physiology.

Bernhardt Saini-Eidukat

Dr. Bernhardt Saini-Eidukat is associate professor and chair of the Department of Geosciences at North Dakota State University. He has B.S. degrees in Geology and Geophysics and a Ph.D. in Geology from the University of Minnesota. He was a Fulbright Scholar and post-doctoral researcher at the Mining University of Leoben in Austria before accepting a position at NDSU in 1993. In 2007, Dr. Saini-Eidukat served as a Fulbright Senior Scholar at the German Federal Institute for Geosciences and Natural Resources (BGR) and as Senior Lecturer at the University of Hanover.

Dr. Saini-Eidukat's research interests are in the broad area of geochemistry. His work has included investigating the geologic processes responsible for concentration of rare elements such as platinum and germanium, and the tectonic history of granitic terranes in Patagonia. Current projects include collaborating in a project to develop a TMDL model for the Upper Souris River of North Dakota, and another project to better understand metal distribution in North Dakota soils.

Bernie has had one student serving as a fellow of the NDWRRI: Damion Knudsen (M.S., in progress). This work involves three dimensional geostatistical modeling of subsurface analyte distributions with the aim of economically optimizing subsurface site characterization.

Antarctic Research by WRRI Research Faculty Gains National and International Recognition

In Science Magazine

Field research in Antarctica by Allan Ashworth, professor in the NDSU Department of Geosciences and an affiliate faculty of the ND WRRI, was featured in Science magazine. The article, "Freeze-Dried Findings Support a Tale of Two Ancient Climates" by journalist Douglas Fox, describes how the discovery of freeze-dried moss has provided evidence about the climate a million years ago in the Dry Valleys of the icy continent. The ancient plant material indicates there was a tundra-like ecosystem in Antarctica 14 million years ago.

Ashworth and his co-researchers studied fossilized vegetation in Antarctic lakebeds. During four expeditions, researchers have collected hundreds of pounds of rock from which fossils have been extracted and studied by researchers around the world.

The article can be found at *www.sciencemag.org/cgi/content/full/320/5880/1152*.

(source: It's Happening at State, NDSU, June 18, 2008)

Featured in 'Ice People' film

Allan Ashworth, university distinguished professor of geosciences, was a featured guest at a preview presentation of the film "Ice People" during the American Museum of Natural History's Polar Year Weekend Feb. 2-3 in New York. Ashworth and his team of Antarctic researchers are featured in the film.

In 2006, Emmy Award-winning filmmaker Anne Aghion spent four months at the U.S. research station McMurdo, and camped out for seven weeks in the "deep field" with Ashworth, research assistant professor Adam Lewis and undergraduate students Kelly Gorz and Andrew Podoll as the researchers studied fossilized vegetation in Antarctic lakebeds. "We previewed the film in a private showing in Fargo. Ashworth's research in Antarctica includes collecting fossils of plants, mollusks and insects that help scientists determine climate changes that occurred millions of years ago. During four expeditions, Ashworth and his colleagues have collected hundreds of pounds of rock from which fossils will be extracted and studied by researchers around the world. "The fossils provide detailed information about the climate – how warm it was." said Ashworth. "For moss to be growing in the center of Antarctica it had to be a lot warmer and wetter than it is today." The research team's discovery of volcanic ash in the deposits lets them date the deposits using radioactive isotopes in the crystals. The fossils and the dates indicate that an abrupt climatic cooling occurred about 14 million years ago marking the transition to the permanent ice sheets that cover the continent today, according to Ashworth. Supported through the National Science Foundation's Antarctic Artists and Writers Program, "Ice People" is scheduled for broadcast on the Sundance Channel and on ARTE in 2008. Ashworth is chair of the U.S. National Committee for Quaternary Research and vice president for the International Quaternary Association.

(Source: Extracted from It's Happening at State, NDSU, Feb 13, 2008)

An Antarctic glacier named in honor

In 2007, the Ashworth Glacier, a glacier in the Ross Sea Region of Antarctica, was named in honor of Ashworth's contributions to science. The research of Ashworth, Lewis and other colleagues is featured in the Washington Post, CNN, The Scientist, GEO magazine and in the future will be part of a NOVA program on climate change in Antarctica.

WRRI Advisory Committee Members

Mike Sauer

Mike Sauer serves as the North Dakota Department of Health representative for the NDWRRI. He is a senior scientist and iimnologist for the Division of Water Quality, ND Department of Health. In this position, Mike manages special projects. These include the development of the ND Water Quality Standards, water quality certification for all federally permitted projects, and review of environmental impact statements. He represents the Department on numerous boards, task forces, and initiatives that involve water quality.

Additional activities include Devils Lake management, Missouri River management, oversight on environmental spill cleanup, and investigation of unusual aquatic events.

In his off time, Mike enjoys hiking, fishing and reading about history and finance

Mike has a BS degree in Biology and a MA degree with emphasis in aquatic biology from St. Cloud State University.

Bill Schuh

Bill Schuh serves as the North Dakota State Water Commission representative for the North Dakota Water Resources Research Institute. He has worked as a hydrologist for the North Dakota State Water Commission for twenty-five years. His job title is "Special Investigations Coordinator," and he works with a wide range of water-related projects and issues.

Bill received his Masters Degree in Soil Science from the University of Minnesota in 1981, specializing in soil physics and water-resource management. He managed an agricultural management cooperative (CENTROL) in eastern Wisconsin for three years before being hired by the North Dakota State Water Commission in 1984 to work with projects related to ground-water recharge. His first assignment in North Dakota was as project leader in field measuring and assembling a soil unsaturated-hydraulic conductivity and water-retention data base. He has since worked with universities and other government agencies in a wide range of field projects, including: Aquifer recharge and recovery, variability of natural recharge, solute movement to ground water, denitrification in aquifers, aquifer and surface-water sulfate sources, assessment of base-line and long-term water quality on the North Dakota National Guard Camp Grafton South Reservation, and assessment of nitrate contamination of ground water.

In addition, Bill has served on a number of advisory committees and task forces: including serving as co-chairman of the technical subcommittee of the Pesticide in Ground-Water Protection Plan committee, the U.S. EPA Section 319 committee, and WAFFLE and Red River Water Management Consortium of the University of North Dakota Energy and Environmental Resource Center. Bill is also the coordinator of a voluntary summer student drill-rig internship program for University of North Dakota and North Dakota State University Geology students.

Recent Publications and Presentations by Institute Fellows and PIs

Publications

Jin, Y., Kannan, S., Wu, M., Zhao, X. (2007). Toxicity of luminescent silica nanoparticles to living cells. Chem. Res. Toxicol. Published on web 07/13/07.

Schuh, Mary, F.X.M. Casey, H. Hakk. (2008). Farm-Scale Reconnaissance of Estrogens in Subsurface Waters. In Annual Meetings Abstracts [CD-ROM]. Joint Annual Meetings of Geol. Soc. Am. Agron. Soc. Am., Crop Sci. Soc. Am., and Soil Sci. Soc. Am., Houston, TX October 5-9, 2008.

Hill, C. and Khan, E. A (2008). Comparative Study of Immobilized Nitrifying and Co-immobilized Nitrifying and Denitrifying Bacteria for Ammonia Removal from Sludge Digester Supernatant. Water, Air, and Soil Pollution, April 2008.

Klapperich, R. J. S., and S. F. Korom, (2007) Electron donor potential of eastern North Dakota shale formations. EOS, Transactions, American Geophysical Union, 88(52), Fall Meeting Supplement, Abstract H13G-1676, 2007.

Presentations

Jin, Y., Wu, M., Zhao, X. (2007). Simultaneous detection of multiple bacterial cells using fluorescent nanoparticles. The Pittsburgh Conference, Chicago, Illinois. February 25 - March 2.

Jin, Y., Wu, M., Zhao, X. (2007). Cytotoxic properties of luminescent nanomaterials. The Pittsburgh Conference, Chicago, Illinois. February 25 - March 2.

Krajangpan, S. , Jarabek, L., Jepperson, J., Chisholm, B., Bezbaruah, A. (2007). Protecting Iron Nanoparticles from Oxidation by Non-target Compounds and Their Effective Subsurface Delivery Using Amphiphilic Polysiloxane Graft Copolymers, ND/SD ESPCoR 6th Biennial Joint Conference, September 7, 2007, Fargo, ND. [Poster]

Krajangpan, S. , Chisholm, B., Bezbaruah, A., (2007). Comparative Studies of Colloidal Stability of Bare and Amphiphilic Polysiloxane Graft Copolymer Coated Iron Nanoparticles and Their TCE Degradation Kinetics. ISNEPP 2007 Nanotechnology in Environmental Protection and Pollution, December 11, 2007, Ft. Lauderdale, FL. [Presentation]

Krajangpan, S., Elorza, J., Bezbaruah, A., Khan, E., Chisholm, B., (2007). Nitrate Removal by Zero-Valent Iron Nanoparticles Entrapped in Calcium Alginate. ISNEPP 2007 Nanotechnology in Environmental Protection and Pollution, December 11, 2007, Ft. Lauderdale, FL. [Presentation]

Hanson, B. R. (2008) "The Use of Channel Characteristics for the Calibration of Index Velocity Ratings for Acoustic Doppler Velocity Meters." Presented at the 2007 USGS Surface-Water Conference and Hydroacoustics Workshop in St. Louis, Missouri, April 3, 2008.

Krajangpan, S., Jarabek, L., Jepperson, J., Chisholm, B., Bezbaruah, A. (2008) The Use of Multifunctional Polymers to Effective Deliver Iron Nanoparticles to Subsurface Contaminants. 235th ACS National Meeting, New Orleans, LA., April 10, 2008. [Poster]

Institute Publications

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

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Thesis and Dissertations

Christopher Hill graduated in August 2008. M.S. thesis: "A Comparative Study of Immobilized Nitrifiers and Co-Immobilized Nitrifiers and Denitrifiers for Nitrification of Sludge Digester Supernatant."

Trent Museus successfully defended his M.S. thesis in May 2008. He plans to graduate in August 2008. Thesis: "A Study of Microbial Regrowth Potential of Water in Fargo, North Dakota and Moorhead, Minnesota."

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Brent Hanson successfully defended his M.S. thesis in May 2008. He plans to graduate in August 2008. Thesis: "The Use of Channel Characteristics for the Calibration of Index Velocity Ratings for Acoustic Doppler Velocity Meters"

Ali Tackett successfully defended her M.S. thesis in April 2008. Thesis: “Genetic distribution and diversity of the Johnny darter (Etheostoma nigrum, Rafinesque) in the Upper Midwest”

Kendall Goltz graduated December 2007. M.S. Thesis: "Implicit prices of wetlands, wetland easements, hunting/recreational sales, and other attributes of farmland in four counties in North Dakota"

Michael Newbrey graduated July 2007. PhD Thesis: “Climate Change and Evolution of Growth in North American Hiodontidae, Esocidae, and Percidae”

Jennifer Newbrey graduated Summer 2007. PhD Thesis: “Maternal condition, carotenoids and reproduction in yellow-head blackbirds”

Aquifer Testing: How Clean Is Our Groundwater?

by Norene Bartelson and Carl Anderson

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(Extracted from North Dakota Water, November 2007)

Groundwater is one of North Dakota's most valuable natural resources. Approximately 60 percent of North Dakota's residents use groundwater for their drinking water, and more than 95 percent of rural residents depend on groundwater as their primary drinking water supply.

North Dakota has many shallow aquifers that provide good quality drinking water. Known as glacial drift aquifers, these aquifers consist of sand and gravel and have fairly shallow water tables. Several of these aquifers are increasingly being used for irrigation, and most of them underlie areas where pesticides and other farm chemicals are used to grow and protect crops. In recent years, the concern for drinking water quality has increased; many states have experienced groundwater contamination from a variety of pollutant sources. Based on recent groundwater concerns, two questions often are asked:

1. Has the use of agricultural chemicals caused groundwater pollution in North Dakota?

2. If impacts have been observed, what can be done to mitigate or eliminate impacts to the aquifer?

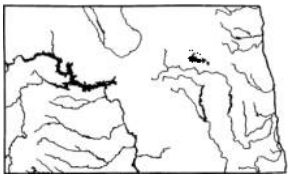
In 1992, the North Dakota Department of Health’s Division of Water Quality initiated a groundwater monitoring program to provide an assessment of the quality of North Dakota's groundwater resources with regard to agricultural chemical contamination. About 50 of North Dakota's most vulnerable aquifers are included in the monitoring program, and each aquifer is sampled on a 5-year rotation cycle in an effort to determine groundwater quality trends.

Monitoring is conducted by collecting water samples from domestic, livestock, observation, irrigation and municipal wells that have been determined to meet the program’s construction standards and sampling requirements. Generally, wells acceptable for sampling are shallow wells that have drilling and well completion logs that document construction of the well and the geology of the aquifer material. The water samples are analyzed for general inorganic chemistry (minerals), trace metals, nitrate plus nitrite (as nitrogen) and 61 selected pesticides.

Between 120 and 320 wells have been sampled each year since the monitoring program began in 1992. Over the years of the program, pesticides have been detected in from 2 to 18 percent of the wells sampled. All wells with pesticide detections are resampled at least once to verify the results of the first test and to determine the persistence of the pesticide. Picloram, more commonly known as Tordon, was the pesticide most frequently detected in groundwater samples collected. Picloram is used as a broad-spectrum herbicide for the Protection Agency and represent the highest level of a contaminant allowed in public drinking water supplies. Although significant contamination in most of North Dakota's aquifers has not been observed, the use of agricultural chemicals has impacted at least one shallow aquifer that supplies drinking water to North Dakota residents. Groundwater within this aquifer has been impacted by nitrates, resulting primarily from the application of fertilizer on irrigated cropland.

The Division of Water Quality and the State Water Commission have been working with area irrigators and producers to mitigate the nitrate contamination. Two groundwater extraction wells have been installed to remove nitrate-contaminated groundwater from the aquifer. The water is then reapplied to agricultural fields, thereby reducing the amount of additional fertilizer that needs to be applied to cropland. Individual irrigators in the area also are evaluating new products, such as Environmentally Smart Nitrogen (a slow-release nitrogen fertilizer), to minimize future contamination of the aquifer. Progress towards aquifer restoration is being made, and the nitrogen load in the aquifer appears to be decreasing.

Based on the data collected to date, it appears that the use of agricultural chemicals has not caused significant or widespread groundwater pollution in North Dakota. The Division of Water Quality will continue to monitor the quality of North Dakota groundwater in an effort to preserve this valuable natural resource. For more information about the Division of Water Quality's groundwater monitoring program, contact the North Dakota Department of Health.



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USGS and CDC Release On-Line Report on Water Quality in Domestic Wells

USGS, in collaboration with the Centers for Disease Control and Prevention (CDC), has released an online report on the occurrence of 11 priority water-quality constituents of possible health concern in domestic wells located in 16 States across the U.S. The newly released study, titled " *Summary of Selected U.S. Geological Survey Data on Domestic Well Water Quality for the Centers for Disease Control's National Environmental Public Health Tracking Program"* by Roy C. Bartholomay, Janet M. Carter, Sharon L. Qi, Paul J. Squillace, and Gary L. Rowe is available online at:http://pubs.usgs.gov/sir/2007/5213/.

USGS anticipates the release of a comprehensive national analysis of domestic wells in Summer 2008, based on samples collected from 2,171 wells by the USGS National Water-Quality Assessment (NAWQA) Program. The wells extend across the U.S., including in 48 of 50 States, and represent 31 of the Nation's 62 principal aquifers used for water supply, irrigation, and other uses. The occurrence and distribution of domestic well quality will be described at the national scale, as well as regionally by principal aquifers. The USGS study will cover 219 physical properties, major inorganic constituents, nutrients, trace elements, organic compounds, radionuclides, and investigate the co-occurrence and common mixtures of constituents of potential human health concern. For more information, access: http://water.usgs.gov/nawqa/gw_domestic_wells.pdf .

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.