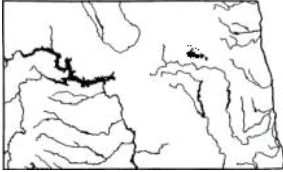
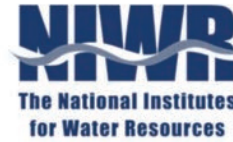


July 2013

North Dakota Water Resources Research Institute  
North Dakota State University  
Fargo, ND 58108-6050



## Newsletter



<http://www.ndsu.edu/wrri>

### Inside this issue:

## From the Director

In this edition, 2013 NDWRRI Fellowship recipients are introduced and last year's Fellowship research projects are highlighted. Four NDWRRI-affiliated faculty are also featured. We encourage you to visit the Institute website, [www.ndsu.edu/wrri](http://www.ndsu.edu/wrri) or contact the respective Fellows, advisors, or principal investigators for details of research projects.

Institute faculty and fellows presented results of their research in several conferences and symposia as in the past years. Their recent publications and presentations are listed in this issue. Technical reports of Fellowship projects are listed and the full report can be accessed on the Institute web site. Several WRRI Fellows graduated and moved on to accept responsible positions in various water-related areas of employment.

The Institute hosted the Third Annual NDWRRI Distinguished Water Seminar and a brief description of the event can be found in this issue. This year, NDWRRI held its Fellowship research presentations in conjunction with the ND Water Quality Monitoring Council meeting in Fargo.

Again this year, North Dakota State Water Commission extended its support of 15% of the USGS annual base grant to the Fellowship program of the Institute. As in the previous years, the State Advisory Committee provided valuable help in setting Institute's research priorities and reviewing Fellowship applications.

Oil development in the western parts of the State continues to put tremendous stress on water resources of the area in terms of quantity and quality. Energy-water nexus is gaining increasing attention. The Clean Water Act requires states and tribes to monitor and assess the quality of its lakes, reservoirs, rivers, streams and wetlands which are considered water quality limited and which require load allocations, waste load allocations and total maximum daily loads (TMDLs) of sediment and nutrients and other pollutants. NPS pollution (e.g., siltation/sedimentation and stream habitat loss or degradation) is the primary cause of aquatic life use impairment. Another concern is the impact of the tile drainage on the quantity and quality of water bodies. Is "managed drainage" achievable? Yet another problem is how to adapt the design and management of infrastructure to the impact of climate change on floods and droughts. These are some water issues in the State which have come to the forefront. State and federal water agencies continue to develop and implement measures to manage water resources quantity and improve the quality of our State's water bodies. There is plenty of scope for research in these areas of concern.

Unfortunately, this year only 60% of the annual base grant proposed was awarded to the Institute due to sequestration. Institute annual base grant funding for next year is in limbo at this time.

G. Padmanabhan, Director

[North Dakota Water Resources Research Institute](http://www.ndsu.edu/wrri)

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Institute Awarded Fourteen Graduate Fellowships for year 2013-2014	2
2012-2013 NDWRRI Fellowship Research Highlights	3
Modeling the Impact of Tile Drainage	6
Join ND Water Quality Monitoring Council and ND WRRI Meeting	6
North Dakota River Watch	7
Featured Faculty	8
Western Water Law and The Missouri River	10
State Water Commission Snow Survey	11
Recent Publications and Presentations by Institute Fellows and PIs	12
Recent USGS Reports	16
Recent ND State Water Commission Publications	16
Recent USEPA Publications	16
3rd NDWRRI Annual Distinguished Water Seminar	17

## The Institute Awarded Fourteen Graduate Fellowships for the Year 2013-2014



Fellow: Prosper Gbolo

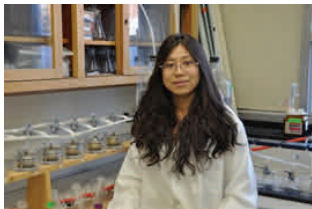
Title: Cycling and fate of phosphorus at an abandoned feedlot

Advisor: Phil Gerla, Geology and Geological Engineering, UND

Fellow: Brian Mager

Title: Physical model evaluations of scour holes below a singular and multiple step rock weirs

Advisor: Howe Lim, Civil Engineering, UND



Fellow: Yangbo He

Title: Sodic soil characterization and management on subsurface drainage

Advisor: Thomas DeSutter, Soil Science, NDSU



Fellow: Rick Thalacker

Title: Mapping techniques for soil erosion, using digital camera, LiDAR and GIS

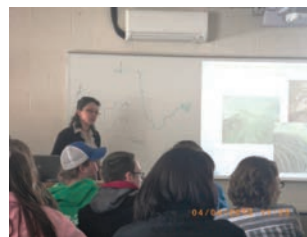
Advisor: Gregory Vandenberg, Geography, UND



Fellow: Kyle Horntvedt

Title: Measurement and modeling of soil moisture changes for subsurface drained and subirrigated fields in the Red River Valley

Advisor: Xinhua Jia, Ag & Biosystems Eng, NDSU



Fellow: Veselina Valkov

Title: Temporal-spatial distribution (dynamics) of phytoplankton and diversity in relation to lake physical and chemical condition

Advisor: Wei Lin, Civil Engineering, NDSU



Fellow: Ruchi Joshi

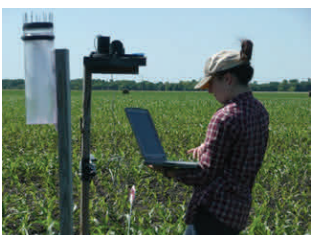
Title: Understanding the survival of cryptosporidium oocysts in North Dakota

Advisor: Eakalak Khan and John McEvoy, respectively Civil Engineering, Veterinary Microbiological Sciences, NDSU

Fellow: Tanush Wadhawan

Title: Investigation of cryptosporidium oocysts in Influent and effluent of the Fargo Water Treatment Plant

Advisor: Eakalak Khan and John McEvoy, respectively Civil Engineering, Veterinary Microbiological Sciences, NDSU



Fellow: Kelsey Kolars

Title: Development of a model for subsurface drainage and subirrigation water management

Advisor: Xinhua Jia, Ag & Biosystems Eng, NDSU



Fellow: Jiexia Wu

Title: Drought monitoring and prediction using NOAA land surface model and GRACE satellite observation

Advisor: Xiaodong Zhang, Earth System Science & Policy, UND

Fellow: Amanda Kreiger

Title: Electron donor contributions to denitrification in the Elk Valley Aquifer, ND

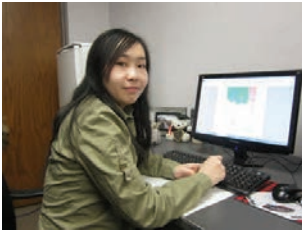
Advisor: Scott Korom, Geology and Geological Engineering, UND



Fellow: Melissa Wygant

Title: A place vulnerability analysis of flood hazard risk at Grand Forks: 1990-2010

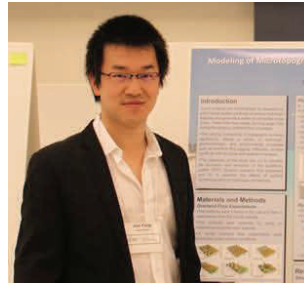
Advisor: Paul Todhunter, Geography, UND



Fellow: Mengqi Xiong

Title: Application of Soil Water Assessment Tool (SWAT) model for estimating nutrient loads to Lake Ashtabula, ND, under different Climate Scenarios

Advisor: Zhulu Lin and G.Padmanabhan, respectively Ag. And Biosystems Engineering and Civil Engineering, NDSU



Fellow: Jun Yang

Title: Improved overland flow modeling for hydrologic connectivity analysis of potholes

Advisor: Xuefeng Chu, Civil Engineering, NDSU

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## Upcoming Events

[Annual Water Resources Conference, American Water Resources Association](#), November 4-7, 2013, Portland, Oregon

[International Weather Radar and Hydrology Symposium](#) April 7-9, 2014, Washington, DC

[Spring Specialty Conference: GIS and Water Resources, American Water Resources Association, May 12-14, 2014](#), Snowbird Resort, Salt Lake City, Utah

[World Environmental & Water Resources Congress](#), June 1-5, 2014, Portland, Oregon

[2014 Summer Specialty Conference: Integrated Water Resources Management: From Theory to Application, American Water Resources Association](#), June 27- July 2, 2014, Reno, NV

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## 2012 – 2013 NDWRRI Fellowship Research Highlights

### *Alex Stalboeger: Tile Drain Water: Identification of Sources and Quality Improvement by Constructed Wetland*

As many North Dakotans and Midwesterners know, the 2012 summer was a dry one. This made collecting water samples from a constructed wetland physically impossible for several months during the summer due to lack of running water. But this also gave us a unique opportunity to test the constructed wetland under dry conditions. Due to the short field season that resulted from the dry weather, several greenhouse experiments were started to test properties of the constructed wetland. We are looking into soil redox potentials, binding capacity of the wetland substrate related to phosphate, sulfate removal efficiency, phosphate removal efficiency, as well as LOI, and multi-element fingerprinting of the constructed wetland substrate. Many of these projects are still in progress or their data being analyzed, however from preliminary data the constructed wetland seems to be behaving as we expected and this 2013 field season has been promising with the amount of water we have received from snow melt and precipitation

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### *Anusha Balangoda: Studies of Seasonal Succession of Cyanobacteria and Green Algae at Heinrich-Martin Impoundment, ND*

Water quality monitoring and water sample analyses were carried out at the Heinrich Martin Dam Impoundment, (HMD) which is located in north central Lamoure County, ND on weekly schedule at six sampling sites (Site A-closer to aeration, Site B-away from aeration, sites C and D- shallow and far from aeration, Site G- closer to inlet, and Site H-located in dead area) in the summer, 2012 under the conditions of aeration. Sampling was carried out between June 20<sup>th</sup>, 2012 and October 3<sup>rd</sup>, 2012 and water samples were analyzed for NO<sub>3</sub>-N, NH<sub>3</sub>-N, TN, TDN, SRP, TRP, Hydrolysable P, TP, TDP, and chlorophyll *a*. In addition, DO, DO saturation, water temperature, specific conductance, turbidity, pH, were measured on site at all locations and secchi depth was measured only at sites A-D.

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### *Atikur Rahman: Vegetative Filter Strips: A Best Management Practice (BMP) for Feedlot Runoff Pollution Control in North Dakota*

The last batch of an ongoing laboratory experiment was conducted in which the effect of vegetative filter strip's soil pH in reducing soluble nutrient transport was investigated. Simulated vegetative filter strips were constructed by using galvanized iron boxes and growing tall fescue grasses on it. Runoff experiment was conducted with manured water to investigate the effect soil pH on soluble nutrient transport reduction. Laboratory analysis of the water samples collected from the runoff experiment was conducted to determine TS, TSS, ortho-P, TP, NH<sub>4</sub>-N, NO<sub>3</sub>-N, TKN, pH, and EC. The analyzed results of samples were processed for statistical calculations. The complete data analysis of results were summarized and described in a report. Partial results of the experiment were presented in an international conference.

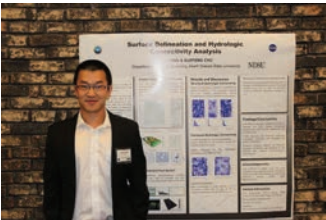
**Hasin Shahad Munna: Advancing Hydrologic Simulations and Flood Frequency Analysis of Devils Lake under Climate Change Scenarios**



The research focuses in calibrating a coupled rainfall-runoff model and a reservoir model for the Devils Lake using data from both ground gage stations and NASA satellite observations. The purpose is to determine the feasibility of using spatially distributed GCM data with a well calibrated hydro-climatic model to predict the probable flood severities. A temperature-based evaporation prediction model is also developed to simulate the outflow from the terminal lake. Future hydrology of the basin and lake levels of Devils Lake are simulated using the weather samples obtained from several downscaled GCM runs under varying scenarios due to anthropogenic modifications and the resulting composition of the atmosphere. 100 traces of future water levels of the Devils Lake have been generated using the predicted temperature and precipitation by the GCMs. The synthetic traces show a

downward trend in water levels for a 30 year simulation period. The annual peak series of the synthetic traces (both stage and volume) are sorted and analyzed to obtain the probabilities and return periods of extreme flood events. The Bulletin 17B recommended LP3 method along with Gaussian/Normal, Lognormal and Gamma/Pearson type 3 distributions are applied for comparison purposes. The Log-Normal probability distribution, in both cases (stage and volume) provided with better fits.

**Jun Yang: Toward Understanding the Hydrologic Process on Topographic Surfaces with Depressions—Development of a Physical-based Puddle-to-Puddle (P2P) Hydrologic Model**



Based on the results from this study, it has been concluded that the “Puddle-to-Puddle” (P2P) overland flow model is capable of (1) quantifying the spatio-temporal distributions and variability of overland flow, (2) characterizing the dynamic depression filling, spilling, and merging processes, (3) simulating infiltration under various topographic surfaces, and (4) revealing the threshold behaviors and hydro-logic connectivity under the influence of surface microtopography. The model also can be utilized to analyze the relationships of depression storage, surface runoff, and infiltration.

**Justin Fisher: Integrating Life Stage Habitat into Landscape Genetics Model for the Conservation of a Declining Amphibian Species**



Focus was on laboratory sample processing and data analysis. Specifically, I DNA and amplified 11 microsatellite markers via PCR (polymerase chain reaction) on an additional 12 populations of *L. pipiens*. This work, combined with the previous data gathered, increased the sample size up to 31 populations (930 total individuals). In addition to the lab work, genetic data were analyzed and effort to build landscape genetic models using a model selection approach was begun. Results indicate that populations are structured throughout North Dakota and that isolation by distance among pair-wise population comparisons was seen. Additionally, a strong east to west trend of decreases in population genetic measures including expected heterozygosity, allelic richness, and effective population size was evident. When radial landscape attributes were extracted in a geographical information system

(GIS), a model selection approach revealed that the number of permanent wetlands (i.e., draught refugia) and percentage of grassland carry the relative model weights and are considered the top models using Akaike’s Information Criterion adjusted for small sample size (AICc). These results have been presented at four different meetings resulting in two best student paper presentations.

**Jiexia Wu: Drought Prediction using NOAH model and GRACE observation**

We used NOAH Land Surface Model and Gravity Recovery and Climate Experiment (GRACE) data examining the 2010-2012 severe drought over the continental US. The drought at surface soil layer and at groundwater level was evaluated using NOAH soil moisture and GRACE TWS, respectively, based on an agricultural drought index that is similar to the Palmer Drought Severity Index but based on soil moisture. In the northwest, both surface and deeper water are in surplus, which in the northeast, the deeper soil is wetter, but the top soil is drier in these three months. We also developed a prognostic model for predicting droughts. We computed the probability of drought predicted for March 2012 with one month lead time based on our model and compared it with Princeton University’s model. While the overall distribution of drought probability is similar between the two, the notable difference is for New Mexico and Texas.

***Katrina Chambers: Quantifying Estrogens Bound to Soil and Manure Colloids and Assessing Their Bioavailability***

The natural estrogen, 17 $\beta$ -Estradiol (E2), is the most potent endocrine disrupting compound, where part per trillion concentrations can induce reproductive abnormalities in sensitive organisms. Estradiol is frequently detected in the environment at concentrations that could impact water quality. Estrogenic hormones will preferentially associate with dissolved (DOC) and colloidal (COC) organic carbon in soil and sediments, playing a significant role in the fate and transport of E2. Field studies have found significant correlations between estrogen detections and DOC and COC in soil leachate and river water. Although the association of E2 with DOC/COC can potentially facilitate its transport and persistence it is also important to identify whether the DOC/COC affects estrogen's toxicological effects. The purpose of this study is to evaluate if E2 bound to DOC/COC is of concern to organisms in the environment. The bioavailability of estradiol bound to DOC/COC will be assessed using estrogen receptor competitive assays, which will be used as analogues to measure hormone receptor binding strength.

***Leslie Storlie: Investigation of Bromate Formation in Ozone Disinfection Systems through Comprehensive Sampling, Water Quality Analysis, and Model Simulation***

The Moorhead Water Treatment Plant (WTP) in Moorhead, MN uses ozone in the disinfection process to remove taste and odor compounds from the Red River of the North as well as meet primary disinfection requirements. Unfortunately, ozone has the potential of oxidizing bromide, which is found naturally in many water sources, to bromate. Bromate has been classified as a possible carcinogen by the EPA and has been given a maximum contaminant level (MCL) of 10 ppb. Knowledge on bromate formation in water treatment plants is limited as many municipalities do not have the capability to test for bromate at low concentrations. Also, most published studies were conducted using bench or pilot scale systems with pH values of 6-8. However, the Moorhead WTP is a 10 MGD facility with a pH during disinfection of 9-11 providing for a unique perspective on bromate formation. To better understand bromate formation in full-scale water treatment systems, a comprehensive study was carried out at the Moorhead WTP in 2012. Bromide concentrations in all source waters, both groundwater and surface water, were monitored determining that the groundwater sources contained more bromide than the surface water source. Water samples from different locations in the ozone chambers were collected and analyzed for bromate and other water quality characteristics. Bromate concentrations were found throughout the ozone chamber and proved to be a valid concern for the facility. Bromate formation was found to be affected by both influent bromide concentrations and operational conditions at the treatment plant. Results indicate that bromate formation was increased by increases in pH, bromide, and ozone dose during times of high temperatures and was decreased by increases in organics. The impact of the bromate influential parameters was minimized at low temperatures. It was also observed that better operational controls need to be developed to minimize bromate formation at the Moorhead WTP. To assist the facility on developing bromate control strategies, a modeling approach was adopted to predict bromate formation at various operational conditions using temperature, pH, ozone dose, bromide, and TOC. The simplicity of the model will allow it to be implemented into the Moorhead WTP SCADA system to provide for "real-time" prediction of bromate formation and allow the treatment facility to minimize bromate formation.

***Michael Quamme: Selenium Removal from Surface and Groundwater Using Iron Nanoparticles***

Selenium removal by NZVI in the presence of Cl<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, PO<sub>4</sub><sup>3-</sup> and As<sup>5+</sup> was investigated, and statistically insignificant effects were observed in the presence of Cl<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, As<sup>5+</sup> and low concentrations of PO<sub>4</sub><sup>3-</sup>, while high concentrations of PO<sub>4</sub><sup>3-</sup> had a statistically significant effect on Se removal.

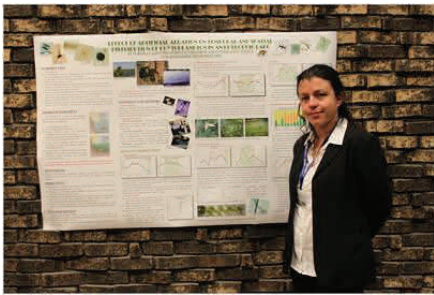
Reuses of the spent (used for Se removal) NZVI particles were also explored. The Se and NZVI uptake by spinach (*Spinacia oleracea*) studies indicated that Se and iron (from spent NZVI) were up taken by plants.

Bare NZVI reduced Se (10 mg/L) by 99% in ~2 h. The Ca-alginate entrapped NZVI achieved a slower yet effective removal (> 85% in 12 h). Comparison of the initial first-order observed reaction rate constants show there is a statistically insignificant difference ( $\alpha = 0.05$ ,  $p = 0.44$ ). The adsorption data was found to best fit the Freundlich adsorption isotherm model with  $R^2 = 0.974$ .

***Tanush Wadhawan: Role of agricultural drainage on transport of Cryptosporidium oocysts in North Dakota***

The effects of two precipitation conditions with varying intensities and durations on *Cryptosporidium parvum* transport were investigated. The experiments were performed in a soil box with a surface area of 172 cm<sup>2</sup>. Chloride tracer or *C. parvum* was applied to the surface of a saturated soil box. Rainfall intensities of 2.5 and 5 cm/h for 1 h duration were simulated using a syringe pump. Conditions were chosen to represent 1 and 10 year rainfall events for Fargo, North Dakota, USA. To simulate snowmelt, the saturated soil box was kept at -20°C for 24 h, after which 200 g of ice (~116 mL of water) was applied. Two subsurface groundwater regimes drained the soil box using a drain tile or a small outlet. Both regimes were studied with and without the overland flow. *Cryptosporidium* was quantified using immunofluorescence microscopy. Our data show that none of the precipitation events could completely drain chloride or *C. parvum*. The numbers of *C. parvum* in the effluent varied from 5% to 50% of the influent. This study provides insight into the transport of *Cryptosporidium* under varying precipitation and subsurface flow conditions. The results generated are useful for understanding the transport of *cryptosporidium* under different groundwater regimes and different precipitation conditions. This information can be used by researchers and practitioners in understanding transport of *Cryptosporidium*.

**Veselina Valkov: Temporal-spatial distribution (dynamics) of phytoplankton and diversity in relation lake physical and chemical condition**



During 2010, 2011 and 2012, eight classes of phytoplankton were identified. Although, Cyanobacteria were expected to thrive at a low Total dissolved Inorganic nitrogen (TDIN):Soluble Reactive Phosphorus(SRP) ratio, they did not dominate in 2010. Instead, in June 2010 and 2011, diatoms out competed the other microalgae. In July 2011, however, diatoms were succeeded by the Cyanobacteria nitrogen-fixing species, Aphanizomenon sp. and Anabaena sp. The dominant species Aphanizomenon sp. formed flattened aggregates 1-20 cm in length and diameter, and each comprised of tens to hundreds of filaments. The aeration did not reduced growth of n-fixing species. In 2012 earlier than in 2011, when aeration did not worked properly, the Aphanizomenon sp also bloom was observed, but aggregates were not detected. When the aeration was stopped on July 13, 2011 and did not worked properly in the beginning of 2012 we observed weak stratification. During that period, the nutrient rich bottom waters were separated from the surface layer and nutrient were no longer available for phytoplankton growth. However, accumulation of nutrients in the hipolimnion indicated that the sediments are the main source of nutrients for phytoplankton growth. The development of bloom was associated with low TDIN:SRP ratio and ability of Aphanizomenon to fix N<sub>2</sub> from the atmosphere. Stopping the aeration limited both phosphorus and nitrogen availability for Aphanizomenon growth. Aggregates disintegrated in separate filaments and accumulated on the surface indicated that organism is stressed. After two weeks without aeration, TDIN and SRP availability declined, which contributed to the bloom collapse.

**Xuelian Bai: Sorption, Degradation, and Mobility of 17b-Estradiol-17-Sulfate in Agricultural Soils**

During the WRII fellowship period, the experimental data were interpreted and a one-site kinetic, first-order model was applied to simulate the coupled sorption and transformation of E2-17S in the various soil-water systems. A global optimization method was used to estimate the parameters of the non-equilibrium model. The model provided good description of the measured data for the parent and metabolite compounds in the aqueous, reversibly sorbed, and irreversibly sorbed phase. The estimated parameters were of relatively high confidence and uniqueness.

## Modeling the Impact of Tile Drainage on Streamflow

Dr. Zhulu Lin, Agriculture and Biosystems Engineering, NDSU, made a presentation titled "Modeling the Impact of Tile Drainage on Streamflow and Water Quality in Red River Using SWAT" in the Red River Basin Water Quality and Watershed Modeling Meeting at the Energy & Environmental Research Center, University of North Dakota, Grand Forks on April 30, 2013. Dr. Lin is an affiliate faculty of NDWRRI. The meeting was attended by various federal and state water agency personnel. There were over 55 participants at the meeting.

Modeling Meeting Proceedings:

<http://redriverbasincommission.info/Proceedings%20for%20the%20RRB%20Water%20Quality%20and%20Watershe/Forms/AllItems.aspx?View=%7b785A0A25%2dD49A%2d4B78%2dAA0B%2dE4D68850263B%7d>

## Joint North Dakota Water Quality Monitoring Council and ND WRII Meeting

This year, for the first time, NDWRRI Fellowship research presentations were organized in conjunction with the North Dakota Water Quality Monitoring Council meeting. The joint meeting was held in Fargo at North Dakota State University on February 7. Several past and present NDWRRI Fellows and faculty advisers presented at the meeting. Several state, federal and private water professionals attended the meeting. The Agenda and presentations can be accessed via the following links:

<http://www.ndsu.edu/wrri/Presentations/North%20Dakota%20Water%20Quality%20Monitoring%20Council%20Meeting%20Agenda-20120207.pdf>

<http://www.ndsu.edu/wrri/Presentations/North%20Dakota%20Water%20Quality%20Monitoring%20Council%20Presentations.html>

<http://www.ndsu.edu/wrri/Presentations/WRII%20Fellowship%20Research%20Presentations.html>

## North Dakota River Watch

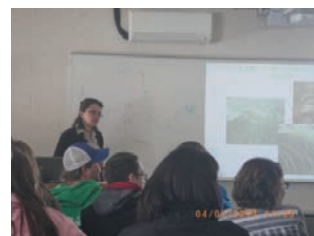
Dr. Andre DeLorme at Prairie Waters Education and Research Center, Kathryn, ND, runs the North Dakota River Watch, a program for high school students to get them involved in water quality monitoring. The Center provides them some equipment (YSI Sonde, Hach turbidimeter, Secchi tube) and train them in the use of the equipment. They, along with their teacher/advisor, develop a project of some sort to monitor the water quality of a river/stream in their area. Currently, eight schools are involved in the program. The program, among other activities, also conducts workshops to bring in graduate students working on water-related projects to speak about their research to the River Watch middle and high school students and teachers. The WRRRI director helped the Center locate speakers for their recent Spring workshop conducted in Kathryn, ND, April 4, 2013. Two ND WRRRI Fellows - Veselina Valkov and Lindsey Meyers - and WRRRI affiliate faculty, Dr. Achintya Bezbaruah presented at the workshop. In addition another grad student, Mary Pate, working in a water-related topic also presented. The topics included lake water quality, nanotechnology applications in water treatment and remediation, wetlands, and an international educational outreach program WateRediscover.



Lindsey Meyers, NDWRRRI Fellow, presenting



A section of audience (students and teachers)



Veselina Valkov, NDWRRRI Fellow presenting

## NDSU-Assam Engineering College, India, Undergraduate Digital Conference

Dr. Achintya Bezbaruah, assistant professor in civil engineering, NDSU and an affiliate faculty of the North Dakota Water Resources Research Institute, organized a teleconference “The Second International WateRediscover Conference” for middle and high school students from four different countries to present water research at NDSU on May 15, 2013. WateRediscover is an international program on water recycling/reuse among middle and high school students. Seven teams from Bangladesh, India, Saudi Arabia, and the USA presented their research findings from their six-month long projects in which they designed, fabricated, tested water treatment and wastewater recycling units following the Engineering Design Process (EDP).

NDSU President Bresciani inaugurated the teleconference. Vice-Chancellor of Tezpur University (India) Dr. Mihir Chaudhuri, NDSU Dean of Engineering and Architecture Dr. Gary Smith, and West Fargo School District Superintendent Dr. David Flowers addressed the participants.



Harjyoti Kalita (NDWRRRI Fellow), Andrea Meyer, Graduate Student Mary Pate, Achintya Bezbaruah at EWRI 2013 at Cincinnati



Achintya Bezbaruah, West Fargo STEM Center Middle School students Jadyn Voeller, Emelia Asa, Alison Ault, STEM Teacher Eric

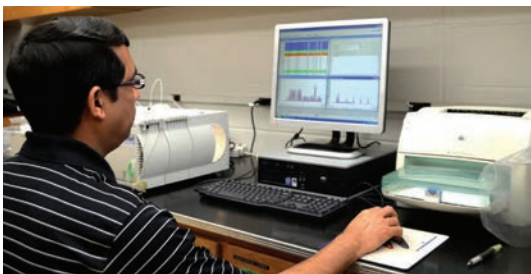


Undergraduate Students Amanda Grosz, Laura Clarens, Achintya Bezbaruah (GlobaKconnect)

## Featured Faculty

### Dr. Shafiqur Rahman

Dr. Shafiqur Rahman is an Assistant Professor in the Department of Agricultural and Biosystems Engineering (ABEN) at North Dakota State University (NDSU). Dr. Rahman received his B.Sc. in Agricultural Engineering from Bangladesh Agricultural University (BAU) in Mymensingh, Bangladesh. He received his M. Eng. Degree in Agricultural Engineering from Asian Institute of Technology (AIT), Bangkok, Thailand and PhD from University of Manitoba, Canada. Dr. Rahman joined as a Natural Sciences and Engineering Research Council of Canada (NSERC) visiting fellow in Eastern Cereal and Oilseed Research Centre (ECORC), Agriculture and Agri-Food Canada (AAFC), Ottawa, Ontario, and worked on tile drainage and water quality from 2004-2006. Before joining at NDSU he worked Iowa State University and Texas A&M University as a Post-Doc research associate and conducted research on air quality from poultry houses.



Dr. Rahman's current research focused on mitigation of nutrients runoff through application of new technologies, production of biogas using manure and other agricultural wastes, measurement of air quality and greenhouse gases (GHG) from livestock production facilities, and demonstration of new technologies to mitigate environmental

concerns from livestock and poultry production systems.

One of Dr. Rahman's PhD students, Atikur Rahman, is a NDWRRI fellowship recipient and Atikur received his PhD degree in May 2013. Atikur worked on vegetative filter strips and other best management practices to reduce nutrient runoff from feedlots. Currently Dr. Rahman has two graduate students: Dhan Gautam and Arjun Thapa. Dhan is a Ph.D student and working on new technologies including nanotechnologies to mitigate air pollution and GHG mitigation from manure. Arjun is a M.S. student and working on biological treatment to reduce nutrient from runoff water.



Dr Rahman in front of his office building

Ongoing research projects are: i) Demonstration and evaluation of vegetative buffer strips to minimize runoff pollution and pathogen from feedlot, ii) Ozone and electrolysis treatment to mitigate pollutant gases and chemical oxygen demand (COD) from swine manure; and iii) Greenhouse gases (Methane, nitrous oxide and carbon dioxide) emission from feedlot facilities in North Dakota. The purpose of these researches is to minimize environmental concern resulting from livestock production facility.

### Dr. Gregory Vandenberg

Dr. Gregory Vandenberg is an Associate Professor in the Department of Geography at the University of North Dakota. He has a B.A. in Geology from the College of St. Thomas (St. Paul, MN), an M.S. in Earth Science (Geology) from Montana State University-Bozeman, and a Ph.D. in Geography from Kansas State University. Dr. Vandenberg was a Research Scientist in the Department of Land Resources and Environmental Sciences at Montana State University prior to joining UND in 2004. He also worked several years for the Montana Department of Environmental Quality. He teaches graduate and undergraduate courses in physical geography, Geographic information Systems (GIS), global positioning systems, and field research methods.

His research interests include the spatial distribution of nutrients and heavy metals in surface water and sediments, identifying areas of critical soil erosion using models in GIS, and water resources from glaciers. Dr. Vandenberg's current research on nutrients and heavy metals in surface water has focused on the upper Devils Lake watershed and the Lake Alice National Wildlife Refuge with support from the U.S. Fish and Wildlife Service and the ND Department of Health. He has also investigated critical areas of erosion in the upper Devils Lake basin with former graduate student, Matt Dinger. This work continues with graduate student Rick Thalacker (M.S. candidate), who recently was awarded a NDWRRI Fellowship to identify areas of critical erosion in the upper Turtle and Forest River watersheds using GIS-based models. Finally, Dr. Vandenberg spent part of last summer working on Continental Glacier in the Wind River Range, WY with Dr. Jeff VanLooy, UND, to determine changes in ice volume as well as glacial melt water contributions to the Wind River system.



Wind River Range, WY 8/2012



## Dr. Wei Lin

Dr. Wei Lin is an associate professor in the Department of Civil Engineering at North Dakota State University. He has a BS degree in sanitary engineering from the Beijing University of Civil Engineering and Architecture, and MS and Ph.D. degrees in civil engineering with an emphasis on environmental engineering from University of Buffalo. Before joining NDSU in 1997, Dr. worked as a senior engineer with Ecology and Environment, Inc. in Lancaster, NY.

Dr. Lin has a broad interest in water quality issues related to water/wastewater treatment and water qualities in rivers and lakes. Currently, he and his students are working with a local water treatment plant studying the impact of source water and operational conditions on bromate, a possible carcinogen, formation in ozone disinfection process. For wastewater treatment, he is interested in the kinetics of pollutant removal in both physico-chemical and biological treatment processes. He has been studying biofilm growth and nitrification in a full scale moving bed biological reactor (MBBR) system, and is developing a kinetic model to explain the impact of temperature on the system performance. His studies also extended to water qualities in rivers and lakes in support of TMDL development and identification of pollution sources. A number of his graduate students have been supported by NDWRRI through its scholarship program on their research projects.

Dr. Lin's teaching responsibilities include undergraduate and graduate courses in the areas of water resources and environmental engineering. He is the faculty advisor of NDSU joint student chapter of American Water Works Association (AWWA) and Water Environment Federation (WEF). He is member of the North Dakota Water Quality Committee. He currently serves as the President of North Dakota Water Environment Association.



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## Dr. Dean Steele



Dr. Dean Steele is an Associate Professor in the Agricultural and Biosystems Engineering (ABEN) Department at North Dakota State University. He has bachelor's and Ph.D. degrees from the University of Minnesota and an M.S. from South Dakota State University. He joined NDSU in 1991 and has taught ABEN courses on computer aided analysis and design, resource conservation and irrigation engineering, and energy and mass transport processes in biological and environmental systems, as well as an Agricultural Systems Management (ASM) course on computer applications in ASM.

Dr. Steele's primary research emphasis has been on irrigation water management, including studies on the effects of irrigation scheduling methods on crop yield and nitrogen leaching, use of subsurface drip irrigation for specialty crops, estimation of crop evapotranspiration (ET), and development of irrigation scheduling software. He studied planting configurations with the aim of improving the water use efficiency of irrigated potatoes. He is working on mapping of ET using satellite images and ground-based weather data with applications including comparison of ET for irrigated and for nonirrigated crops and the use of ET maps as an indicator of the spatial variability of soil productivity. Dr. Steele participates in teams conducting research on agricultural drainage, such as the effect of subsurface drainage on soil physical and hydraulic properties and the determination of irrigation uniformity for a subirrigation system. Another research study is evaluating the performance of an optical rain sensor.

## Western Water Law And The Missouri River (From the North Dakota State Water Commission Oxbow May 2013)

By Steve Best

During the summer of 1889, the first North Dakota Constitutional Convention members were laying the groundwork for what would officially become the State of North Dakota that same year. On August 5, 1889, Major John Wesley Powell, Director of the US Geological Survey, delivered a speech before the Constitutional Convention regarding, foremost the importance of irrigation.

In that speech, Powell not only set the stage for North Dakota's future irrigation development, but also for all water management decisions that would evolve over the course of the state's history. In what have proven to be prophetic remarks, Powell reminded the convention delegates of the volatile nature of North Dakota's climate, and stressed the importance of water in any equation for future success. Most importantly, Powell urged the convention delegates to retain ownership of the state's water resources for the good of the people.

At Powell's urging, members of the Constitutional Convention adopted a constitutional provision for the state's water resources, which says, "All flowing streams and natural water courses shall forever remain the property of the state for mining, irrigation, and manufacturing purposes." To date, this provision remains in the North Dakota State Constitution and is the foundation for legislative decisions in managing North Dakota's water resources.

Additionally, in the early 1900s, North Dakota adopted the fundamentals of Western Water Law, as did many other western states. Western Water Law uses the Prior Appropriation Doctrine in establishing water rights for beneficial use. Basically, the phrase "first in time – first in right" describes how this principal works. The first person, municipality, or other entity, which applies for a water use permit along a waterway for beneficial use, has priority over less senior water users in times when water is not as plentiful. Because North Dakota is a western water law state, it is important to have the ability to appropriate water from the Missouri River without interference. The Missouri River is the state's most valuable and readily available water source and is needed for a broad spectrum of beneficial uses, such as irrigation, water supplies, and industry.

The State of North Dakota owns the rights to the natural flows of the Missouri River into and through Lake Sakakawea and Oahe. Historic flows of the Missouri River near Williston are approximately 17.6 million acre-feet annually. Only 570,000 acre-feet were permitted by the state for beneficial use in 2010. Approximately 81% of the permitted acre-feet of water is used for power generation and returned to the river. By evaluating the inflows and permitted acre-feet for beneficial use it is clear that the people of North Dakota use only a small portion of water that flows through the Missouri River. Thus, North Dakota's Missouri River water users do not rely on water stored behind the dams.

In spite of the fore-thought that the State Constitutional Convention had in 1889, the State of North Dakota is currently in conflict with the US Army Corps of Engineers (Corps) over their proposed Surplus Water Policy. This proposed policy is very complex, but in general, the Corps contends they have authority through the Flood Control Act of 1944 to charge fees for the use of "surplus" stored water in the mainstem reservoirs. The Corps defines surplus water as water that is available because of authorized project uses that were never fully developed. In the case of Garrison Dam / Lake Sakakawea, this is water not being utilized from unfinished irrigation projects, including those associated with the Garrison Diversion project.

The ongoing development of this policy has included many public meetings between the Corps and North Dakota residents, yet it seems that the Corps does not recognize that the flows of the Missouri River belong to the state.

In February 2013, the Corps lifted its moratorium, which had been in place since 2010 on new real estate easements around Lake Sakakawea, which had blocked access to new water withdrawals around the lake. They have also recently announced that two industrial companies have entered into surplus water agreements. Fees are not yet being mandated on these agreements until a rule or national policy is developed.

The fathers of North Dakota's Constitution were prudent and had the foresight to protect the state's water resources for beneficial use by its people. Yesterday, today, and for years to come, the natural flows of the Missouri River rightfully belong to the people of North Dakota, and all citizens should work hard to preserve these rights that are being jeopardized in the proposed water surplus policy fees being considered by the Corps. Understanding this new policy and the potential impact on water users in North Dakota is paramount. While fees are not currently being charged for water use, if this policy passes, it has the potential to increase the cost of water to not only industrial users, but also municipalities and rural water suppliers who have to cross Corps of Engineers property to access their water supply from the Missouri River.

If Major John Wesley Powell were here today to see this most recent dispute over Missouri River Water, he would most certainly advise the state and its citizens to stand their ground. North Dakota's water resources should indeed remain the property of the state. This concept – since the Constitutional Convention, is not new, nor is it negotiable.

## State Water Commission Snow Survey (From the North Dakota State Water Commission Oxbow April 2013)

In a region where significant flooding occurs frequently, a good understanding of the moisture content in the snowpack is an important tool for being able to predict spring runoff. In order to get more accurate snowpack moisture information in the state, the Water Commission's survey crew conducts targeted snowpack measurements as-needed, at various times during the winter.

The moisture content in snowpack is a powerful tool for aiding in the prediction of what kind of spring flooding may occur. This information can aid forecasters, emergency managers, cities, and counties in determining what, if any, flood protection measures need to be implemented. Remote sensing, such as satellite or aerial data collections are also valuable tools in helping to forecast spring conditions, but this data must be verified in the field. Physical measurements of snow moisture make remotely collected data more accurate.

The Water Commission's snowpack sampling areas are chosen in areas where there is insufficient information. Common sampling areas are the Devils Lake and Pembina River basins, but on the ground conditions can lead to samples being taken anywhere in the state. Generally, four to twelve sites are chosen in a given basin, for the sampling crew to collect data. These sites are chosen based upon need, as determined by Water Commission staff, with input from involved entities, such as the U.S. Army Corps of Engineers, National Weather Service, cities, and counties.

Snowpack sampling involves travelling to predetermined locations within a basin, visually determining a site that is representative of snowpack in the area, and avoiding areas such as the only snowdrift in a bare field, or the only bare spot surrounded by 3-foot deep snow. The depth of the snow is measured with a yardstick, and then a snow sample is weighed, providing moisture content. This data is then provided to the Water Commission's collaborative partners.

Other entities also collect snowpack measurements related to their specific areas of interest. In North Dakota, groups such as the National Weather Service (<http://www.nws.noaa.gov/om/coop/>), St. Paul and Omaha Districts of the U.S. Army Corps of Engineers (<http://www.nwd-mr.usace.army.mil/rcc/snowsury/snowsury.html>) and the Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) (<http://www.cocorahs.org/>) all collect snowpack moisture information.

In addition to the State Water Commission's snow survey work, in 2010 the Atmospheric Resource Board (ARB) added snow moisture measurements to their observer network, which provides a statewide perspective. (More on ARB's efforts in their section of this issue of ND Water.) On the Water Commission's MapService (<http://mapservice.swc.nd.gov>) snowpack moisture content is available as an interactive map, using data from the National Weather Services Snow Data Assimilation System (SNODAS) (<http://nsidc.org/data/g02158.html>). The Water Commission snow sampling team is one of many efforts being undertaken throughout the state. The trick is to utilize resources wisely, and to ensure that the data gets to the end user.

*"What amazes me, are the citizen volunteers that are going out and collecting this data every day. The service these volunteers provide is extremely valuable. We are simply just trying to fill in the holes."* explains Kelly Casteel, P.E., the manager of the Water Commission snow survey team.

The snowpack information provided by the Water Commission and its partners help to ensure more accurate predictions of spring runoff conditions, supporting the agency goal of managing the state's water resources for the benefit of its citizens.



## Recent Publications and Presentations by Institute Fellows and Pls

### Journal Papers

**Donna L Jacob**, Joshua D Borchardt, Leelaruban Navaratnam, **Marinus L Otte**, **Achintya N Bezbaruah** (2013) Uptake and translocation of Ti from nanoparticles in crops and wetland plants. *International Journal of Phytoremediation* 01/2013; 15(2):142-53.

**H Simsek**, **M Kasi**, JB Ohm, M Blonigen, **E Khan** (2013) Bioavailable and biodegradable dissolved organic nitrogen in activated sludge and trickling filter wastewater treatment plants, *Water Research*

**H Simsek**, **M Kasi**, **T Wadhawan**, C Bye, M Blonigen, **E Khan** (2013) Fate of dissolved organic nitrogen in two stage trickling filter process, *Water Research*

Leelaruban, N., P. Oduor, A. Akyuz, S. Shaik, and **G. Padmanabhan** (2012) Leveraging a Spatio-Temporal Drought Severity and Coverage Index with Crop Yield Modeled as a Stochastic Process, in *International Journal of Hydrology Science and Technology (IJHST)* Vol. 2 No. 3

**Murthy Kasi**, **Tanush Wadhawan**, **John McEvoy**, **G Padmanabhan**, **Eakalak Khan** (2012) Effect of carbon source during enrichment on BTEX degradation by anaerobic mixed bacterial cultures, *Biodegradation*, 08/2012; DOI:10.1007/s10532-012-9586-1.

**Rahman, A.**, **S. Rahman**, and M.S. Borhan. 2013. Performance evaluation of three vegetative filter strip designs for controlling feedlot runoff pollution. *Journal of Civil and Environmental Engineering* 3: 124. doi:10.4172/2165-784X.1000124

Shrestha, S. L., **Francis X. M. Casey**, Heldur Hakk, and **G. Padmanabhan** (2013) Radioassay-Based Approach to Investigate Fate and Transformation of Conjugated and Free Estrogens in an Agricultural Soil, *Environmental Engineering Science*, Volume 30, Number 2, 2013, DOI: 10.1089/ees.2012.0206

Shrestha, S. L., **Francis X. M. Casey**, Heldur Hakk, David J. Smith, and **G. Padmanabhan** (2012) Fate and Transformation of an Estrogen Conjugate and Its Metabolites in Agricultural Soils, *Environmental Science and Technology*, Oct. 2012 46(20):11047-53.

**Sita Krajangpan**, **Harjyoti Kalita**, **Bret J Chisholm**, **Achintya N Bezbaruah** (2012) Iron nanoparticles coated with amphiphilic polysiloxane graft copolymers: dispersibility and contaminant treatability. *Environmental Science & Technology* 06/2012; 46(18):10130-6.

### Conference Proceedings

**Bezbaruah**, A.N., Erickson, H., Dobervich, E., Laux, J., Varholdt, J., Gehlhar, A., Weber, M., Kalita, H., Almeelbi, T., **Quamme, M.**, Pate, M., Hossain, M.E., Grosz, A., Pergande, M. Sustainability and Nanotechnology Education in K-12: Hands-on Teaching Modules for Middle School Students and Summer Research Experience for High School Students, World Environmental & Water Resources congress, Cincinnati, OH, May, 2013.

**E Khan**, **T Wadhawan**, **M Kasi**, **G Padmanabhan**, **J McEvoy** (2012) Reintroduction of Contaminant in Groundwater Alters Bacterial Community, Water Environment Federation Annual Technical Exhibition and Conference, pp. 6515-6523.

**Gbolo, P.**, and **Gerla, P.**, "Assessing the Effects of Groundwater and Soil Nutrients on Vegetation Indices", ND EPSCoR Conference, Alerus Center (Grand Forks, ND - 2012).

**Gbolo, P.**, and **Gerla, P.**, "Ground conditions and the fate of nutrients at the former Crookston Cattle Company", North Dakota Academy of Science Meeting (Bismarck, ND - March 2012), and the University of North Dakota Scholarly Forum (Grand Forks, 2012). Available at: <http://graduateschool.und.edu/learn-more/sf12-poster-assignments.pdf> (pg. 8).

**Gbolo, P.**, and **Gerla, P.**, "Nutrient variability in soils and plants in an abandoned cattle feedlot", North Dakota /South Dakota Engineering Research Summit (Brookings, SD - April 2013).

**Gbolo, P.**, and **Gerla, P.**, 2013. Statistical analysis to characterize transport of nutrients in groundwater near an abandoned feedlot. *Hydro. Earth Syst. Sci. Discuss.* 10:1553-1579. Available at: <http://www.hydrol-earth-syst-sci-discuss.net/10/1553/2013/hessd-10-1553-2013.pdf>

**Lim, Y. H.**, Zhang, X., Kirilenko, A., Teng, W. and **Munna, H. S.** (2012, May). "Flood Frequency Analysis of Devils Lake under Current and Projected Future Climates Utilizing HEC Hydrologic Models, NASA Satellite Observations and Downscaled GCM Simulations", World Env. and Water Res. Congress, ASCE-EWRI, Albuquerque, New Mexico.

**Munna, H.S.** (2012, May). "Development of a Temperature-based Model to Simulate Evaporative Losses over Water Bodies in Cold Regions", World Environmental and Water Resources Congress, ASCE-EWRI, Albuquerque, New Mexico.

**Munna, H.S.** and **Lim, Y. H.** (2012, May). "An Efficient Method for Predicting Evaporative Losses over Water Bodies in Cold Regions using a Temperature-Based Model", Poster Paper, World Env. and Water Res. Congress, ASCE-EWRI, Albuquerque, New Mexico.

**Quamme, M.**, Almeelbi, T., **Bezbaruah, A.N.** Selenium Removal from Surface Waters: Exploratory Research with Iron Nanoparticles, World Environmental & Water Resources congress, Albuquerque, NM, May, 2012.

**Quamme, M.**, Feist, B., **Bezbaruah, A.N.** Entrapment of Iron Nanoparticles in Alginate Beads for Aqueous Selenium Removal, World Environmental & Water Resources congress, Cincinnati, OH, May, 2013.

**Stalboerger, Alex.** **Jacob, Donna** and **Otte, Marinus** "Sulfate Removal from Agriculture Tile Drain Water by Constructed Wetlands" presentation ND Water Quality Monitoring Council meeting, Fargo, North Dakota, February 2013

**Wadhawan, T.**, Kasi, M., Chu, M., **Khan, E.**, **McEvoy, J.** 2012. Bench-scale rainfall and snowfall simulations to understand *Cryptosporidium parvum* transport in subsurface groundwater regimes. IV International Giardia and *Cryptosporidium* Conference, Wellington, New Zealand.

**Wadhawan, T., Kasi, M., McEvoy, J., Chu, M., Khan, E.** 2012. Investigating transport of Cryptosporidium under snowmelt conditions. World Environmental and Water Resources Congress. Albuquerque, New Mexico, USA.

**Yang, J. and Chu, X.,** 2012. Effects of Surface Microtopography on Hydrologic Connectivity. ASCE 2012 World Environmental and Water Resources Congress, May 20-24, 2012, Albuquerque, NM.

### *Conference/Seminar Presentations*

**Balangoda, A. and Lin, W.** Impacts of Eutrophication on Water Quality at Heinrich-Martin Dam Impoundment, North Dakota. 2nd Annual ECS Poster Session, November 2nd, 2012.

**Balangoda, A.,** Valkov, V., Zhao, J., **Lin, W.** Seasonal Variation of Water Quality and Algal Growth in the Heinrich-Martin Dam Impoundment, North Dakota. North Dakota Water Quality Monitoring Conference, February 27-29, 2012.

**Casey, F.X.M.,** S. Shrestha, X. Bai, **K. Chambers** and H. Hakk. 2012. Role of Conjugates in the Fate and Transport of Steroid Hormones. In Annual Meetings Abstracts [CD-ROM]. ASA, CSSA, and SSSA, Madison, WI.

**Chu, Xuefeng and J Yang.** 2012. A New Surface Delineation Approach for Characterizing Threshold-Driven Watershed Processes - Introduction to the Puddle-to-puddle (P2P) Modeling System. Fifty Years of Watershed Modeling - Past, Present and Future, Engineering Conferences International, September 24-26, 2012, Boulder, CO.

**Fisher, J.,** K. Purcell and **C. Stockwell.** Genetic Diversity of the Northern Leopard Frog Across the 100th Meridian. 9th Annual Northern Plains Biological Symposium, Fargo, ND, 04/2012

**Fisher, J.,** K. Purcell and **C. Stockwell.** Genetic Diversity of the Northern Leopard Frog Across the 100th Meridian. Society for Conservation Biology – North American Congress for Conservation Biology, Oakland, CA, 07/2012

**Fisher, J.,** K. Purcell and **C. Stockwell.** Landscape Influences on Effective Population Size of Northern Leopard Frog Populations in North Dakota. 50th Annual Meeting of the North Dakota Chapter of The Wildlife Society, Mandan, ND, 02/2013 \*\*Best Student Paper Award

**Fisher, J.,** K. Purcell and **C. Stockwell.** Survey of the Genetic Diversity of Northern Leopard Frog Populations in North Dakota. Joint Annual Meeting of the Minnesota & North Dakota Chapters of The Wildlife Society, Fargo, ND, 02/2012 \*\*Best Student Paper Award

**Munna, H.S** - Seminar presentation on “Water Level Quantiles of a Terminal Lake under Future Climate Change Conditions” (2012, April) at the “Terrestrial Water Cycle Seminar”, NASA’s Goddard Space Flight Center, Greenbelt, Maryland.

**Munna, H.S. and Lim, Y. H.** (2010, Dec). “Coupling of HEC-HMS and HEC-ResSim in Modeling the Fluctuation of Water Level in Devils Lake Using Heterogeneous Data”, Poster Paper, Abstract H43F-1324 presented at 2010 Fall Meeting, American Geophysical Union, San Francisco, California.

**Rahman, A.** 2013. Vegetative filter strips for controlling feedlot runoff pollution in North Dakota. Presented at the Water Quality Monitoring Council meeting and ND-WRRI Fellowship Research Presentations. February 7, 2013, North Dakota State University, Fargo, North Dakota.

**Rahman, A., S. Rahman,** and L. Cihacek. 2012. Effect of pH in vegetative filter strips in reducing manure borne soluble nutrients in runoff. Presented at the 2012 ASABE Annual International Meeting Sponsored by ASABE Dallas, Texas July 29 – August 1.

**Storlie, Lelie.** 2012 ND WPCF Fresh Ideas Poster Competition, “An Investigation into Bromate Formation in the Ozone Disinfection Process”, first place, Minot, ND, October 17th, 2012.

**Storlie, Leslie.** 2013 AWWA ACE National Poster Competition, “An Investigation into Bromate Formation in the Ozone Disinfection Process”, Denver, CO, June 10th-13th, 2013.

**Storlie, Leslie.** 2012 MN AWWA Fresh Ideas Poster Competition, “An Investigation into Bromate Formation in the Ozone Disinfection Process”, second place, Duluth, MN, September 20th, 2012.

**Veselina Valkov** “Cyanobacteria bloom and collapse in an eutrophic lake” presentation ND Water Quality Monitoring Council meeting, Fargo, North Dakota, February 2013

**Veselina Valkov** “The effect of artificial aeration on phytoplankton growth in a small eutrophic lake in North Dakota” presentation at River Watch Spring Workshop, Kathryn, North Dakota, April 2013

**Xiaodong Zhang, Jixia Wu,** Eric Castle, Drought prediction using GRACE observation and NOAA model simulation, AGU Annual Conference, San Francisco, 3-7 December, 2012

**Yang, J, Bogart, D., and Chu, X.,** 2012. Quantification of the Spatio-temporal Variability in Threshold-controlled Overland Flow Generation Processes – A Combined Experimental and Modeling Study. AGU Fall Conference, December 3-7, 2012, San Francisco, CA.

**Yang, J. and Chu, X.,** 2012. Modeling of Microtopography-Controlled Hydrologic Connectivity and Overland Flow Dynamics. The 2nd Annual Engineering Research Summit, April 23, 2012, Grand Forks, ND.

### *Patent*

Almeelbi T., **Quamme M.**, **Bezbaruah A.N.** Aqueous Phosphate Removal using Iron Cross-lined Alginate, Patent Filed, (RFT-419A), 2012.

Almeelbi, T., **Quamme, M.**, Khan, E., **Bezbaruah, A.N.** Selenium Removal from Surface Waters: Exploratory Research with Iron Nanoparticles, Patent Filed, (RFT-419B), 2012

### **THESES AND DISSERTATIONS**

Katrin Chambers, M.S. in Soil Science, graduated in March 2013

Adviser: Francis Casey

Bioavailability of  $17\beta$ -Estradiol Associated with Soil and Manure Colloidal and Dissolved Fractions.

Chase Christenson, defended his thesis successfully, M.S. in Geology and Geological Engineering in May 2013

Adviser: Scott Korom

Effects of Iron Bacteria on Subsurface Tile Drains: Influence on Nutrient Transport

Michael Quamme, M.S. in Environmental Engineering, graduated in May 2013

Adviser: Achintya Bezbaruah

Utilization of Nanoscale Zero-Valent Iron for the Removal of Selenium from Aqueous Environments

Atikur Rahman, Ph.D. in Ag and Biosystem Engineering, graduated in March 2013

Adviser: Shafiqur Rahman

Vegetative Filter Strips: A Best Management Practice (BMP) for feedlot runoff pollution control in North Dakota

Halis Simsek, Ph. D in Civil Engineering, graduated in December 2012

Adviser: Eakalak Khan

Fate and characteristics of dissolved organic nitrogen through wastewater treatment systems

Leslie Storlie, M.S. Civil Engineering, graduated in May 2013

Adviser: Wei Lin

An Investigation into Bromate Formation in Ozone Disinfection Systems

Andrea Hanson, expected to graduate in December 2013, M.S. in Biological Sciences

Adviser: Mark Sheridan

Lindsey Meyers, expected to graduate in December 2013, Ph.D. in Natural Resources management

Advisers: Edward Dekeyser and Jack Norland

### **Institute Publications**

Technical Report No: ND12-01

ECOSYSTEM SERVICES AND WETLAND CONDITION ASSESSMENT IN THE PRAIRIE POTHOLE REGION

Lindsey M. Meyers, Edward S. DeKeyser, and Jack E. Norland

Technical Report No: ND12-02

REFERENCE EVAPOTRANSPIRATION AND ACTUAL EVAPOTRANSPIRATION

MEASUREMENTS IN NORTH DAKOTA

Ishara Rijal and Xinhua Jia

Technical Report No: ND12-03

FATE OF BIODEGRADABLE DISSOLVED ORGANIC NITROGEN IN FARGO WASTEWATER

Halis Simsek and Eakalak Khan

Technical Report No: ND12-04

TECHNIQUES OF ASSESSING CHANGES IN RIVER FLOODING PATTERNS IN THE UPPER MIDWEST

Kyle Hafliger and Yeo Howe Lim

Technical Report No: ND12-05

MULTI\_ELEMENT FINGERPRINTING OF RIVER SEDIMENTS TO IDENTIFY DIFFUSE POLLUTION SOURCES

Dimuthu Wijeyaratne and Marinus Otte

Technical Report No: ND12-06

DEVELOPMENT OF FE-GAC ADSORBENT FOR ARSENIC REMOVAL

Qigang Chang and Wei Lin

Technical Report No: ND12-07

SOURCE TRACKING OF CRYPTOSPORIDIUM IN THE RED RIVER VALLEY

Brianna L.S. Stenger, Mark E. Clark, John M. McEvoy

Technical Report No: ND12-08

ALGINATE ENCAPSULATED NANOPARTICLE-MICROORGANISM SYSTEM FOR TRICHLOROETHYLENE REMEDIATION

Sai Sharanya Shanbhogue and Achintya N. Bezbaruah

Technical Report No: ND13-01

TOWARD UNDERSTANDING THE HYDROLOGIC PROCESSES ON TOPOGRAPHIC SURFACES WITH DEPRESSIONS—MODELING AND APPLICATIONS

Jun Yang and Xuefeng Chu

Technical Report No: ND13-02

TILE DRAIN WATER: IDENTIFICATION OF SOURCES AND QUALITY IMPROVEMENT BY A CONSTRUCTED WETLAND

Alex Stalboerger, Donna Jacob and Marinus Otte

Technical Report No: ND13-03

EFFECTIVE DELIVERY OF IRON NANOPARTICLES BY AMPHIPHILIC POLYSILOXANE GRAFT COPOLYMERIC VEHICLES FOR GROUNDWATER REMEDIATION

Sita Krajangpan, Bret J. Chishlom and Achintya N. Bezbaruah

Technical Report No: ND13-04

COMPARISON OF DENITRIFICATION POTENTIAL AROUND A TILE DRAIN AND IN AQUIFER SEDIMENTS: OAKS, ND

Chase J. Christenson and Scott F. Korom

*Institute publications can be accessed via the Institute web site: <http://www.ndsu.edu/wrri>*

## Recent USGS Reports

Prioritization of Constituents for National- and Regional Scale Ambient Monitoring of Water and Sediment in the United States, Lisa D. Olsen, Joshua F. Valder, Janet M. Carter, and John S. Zogorski National Water-Quality Assessment Program, Scientific Investigations Report 2012–5218, USGS, US Department of Interior, 2013. <http://pubs.usgs.gov/sir/2012/5218/sir12-5218.pdf>

U.S. Geological Survey Water science strategy--observing, understanding, predicting, and delivering water science to the nation 2013, Evenson, Eric J.; Orndorff, Randall C.; Blome, Charles D.; Böhlke, John Karl; Hershberger, Paul K.; Langenheim, Victoria E.; McCabe, Gregory J.; Morlock, Scott E.; Reeves, Howard W.; Verdin, James P.; Weyers, Holly S.; Wood, Tamara M.; USGS Circular: 1383-G <http://pubs.usgs.gov/circ/1383g/circ1383-G.pdf>

USGS Circular: 1383-A U.S. Geological Survey climate and land use change science strategy: a framework for understanding and responding to global change <http://pubs.er.usgs.gov/publication/cir1383A>

USGS Circular: 1383-B U.S. Geological Survey core science systems strategy: characterizing, synthesizing, and understanding the critical zone through a modular science framework <http://pubs.er.usgs.gov/publication/cir1383B>

USGS Circular: 1383-C U.S. Geological Survey Ecosystems science strategy--advancing discovery and application through collaboration <http://pubs.er.usgs.gov/publication/cir1383C>

USGS Circular: 1383-D U.S. Geological Survey Energy and Minerals science strategy--a resource lifecycle approach <http://pubs.er.usgs.gov/publication/cir1383D>

USGS Circular: 1383-E U.S. Geological Survey environmental health science strategy: providing environmental health science for a changing world <http://pubs.er.usgs.gov/publication/cir1383E>

USGS Circular: 1383-F U.S. Geological Survey natural hazards science strategy: promoting the safety, security, and economic well-being of the Nation <http://pubs.er.usgs.gov/publication/cir1383F>

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## Recent ND State Water Commission Publications

North Dakota Water Development Plan 2013-2015, ND State Water Commission, January, 2013

Groundwater Flow Model Inversion to Assess Water Availability in the Fox Hills—Hell Creek Aquifer, Kimberly Fischer, Water Resource Investigation No. 54, 2013

Availability and Quality of Surface and Groundwater Resources in West-Central and Southwest North Dakota, Robert Shaver, Water Resource Investigation No. 53, 2012

Assessment of Potential Use of Telemetry for Monitoring Oil-field Water Use, North Dakota State Water Commission Water Appropriations Division Staff, January 11, 2013

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## Recent USEPA Publications

National Rivers and Streams Assessment 2008–2009 A Collaborative Survey DRAFT, EPA/841/D-13/001, U.S. Environmental Protection Agency Office of Wetlands, Oceans and Watersheds Office of Research and Development Washington, DC 20460, February 28, 2013 [http://water.epa.gov/type/rsl/monitoring/riverssurvey/upload/NRSA0809\\_Report\\_Final\\_508Compliant\\_130228.pdf](http://water.epa.gov/type/rsl/monitoring/riverssurvey/upload/NRSA0809_Report_Final_508Compliant_130228.pdf)

National Environmental Methods Index, National Water Quality Monitoring Council, USGS and EPA. <https://www.nemi.gov/home/>  
NEMI is a searchable database of environmental methods, protocols, and procedures that allows scientists and managers to find and compare data-collection methods and protocols for all stages of the monitoring process.



### 3rd NDWRRI Annual Distinguished Water Seminar

The 3rd Annual Distinguished Water Seminar was held on October 22, 2012 at NDSU campus open to faculty and students of NDSU and UND and the public. Dr. Donald Rosenberry, U.S. Geological Survey, National Research Program in Denver, Colorado conducted the seminar titled, " The importance of groundwater to lakes, wetlands, and streams: New methods, new understanding, and the societal relevance of research at the sediment-water interface." The talk was co-sponsored by the departments of Civil Engineering, Agricultural and Biological Engineering, Geosciences, the Environmental and Conservation Sciences program, and the School of Natural Resources Sciences, all of North Dakota State University. The seminar is the third of the annual Distinguished Water Seminar series by eminent water professionals on emerging issues, challenges and new research directions in water resources.

Abstract: The concept that groundwater and surface water are actually one resource, linked at the sediment-water interface of lakes, wetlands, and streams, is now widely accepted by water-resource scientists and managers alike. Recent improvements in tools and measurement resolution have led to better understanding of the physical, geochemical, and biological processes that occur at this important ecotone, but this research is not just the esoteric pursuit of scientists. These processes and linkages are directly relevant to the public, particularly when they affect property values or endangered species. Examples from out-of-control wetlands and lakes in North Dakota and Minnesota, to highly controlled lakes and rivers in Washington, California, Pennsylvania, and New Hampshire, will illustrate the dynamic nature of this interface and how the public is affected, sometimes greatly, by the linkage between groundwater and surface water.



From Left to Right: Mark Wiltermuth (USGS, Northern Prairie Wildlife Research Center, Jamestown, ND students, Dr. Donald Rosenberry (USGS Hydrologist) and Marinus Otte (Biological Sciences, NDSU) in a discussion



David Hopkins (Soil Science, NDSU and Dr. Donald Roseberry, (USGS Hydrologist in a discussion

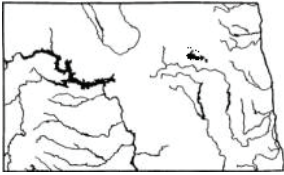


Dr. Donald Roseberry, (USGS Hydrologist ) explains



From Left to Right G. Padmanabhan (NDWRRI Director, NDSU), Marinus Otte (Biological Sciences, NDSU); Dr. Donald Rosenberry (USGS Hydrologist), Robert Hearne (Agricultural Economics, NDSU) and Karen Ryberg (Statistician, USGS, Bismarck in a before dinner discussion

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Kyle Horntvedt and NDSU-ABEN Technician Dongqing Lin finished setting up one of four wireless weather stations in a research field

## North Dakota Water Resources Research Institute (NDWRRRI)

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 NDWRRRI 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.