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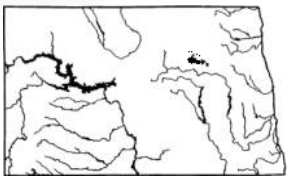
North Dakota Water Resources Research Institute
North Dakota State University
Fargo, ND 58108-6050



Newsletter

The National Institutes for Water Resources

http://www.ndsu.edu/wrri

From the Director

Oil development in the western parts of the state has introduced tremendous stress on water resources of the area in terms of quantity and quality. The potential impact of energy pipelines on the state's water resources is another concern. These are some of the water issues that are in the forefront of discussions in the past year or so. Though energy-water nexus is being talked about frequently, in-depth analyses of the related issues are yet to be undertaken. It is important to establish baseline water quantity and quality measurements and assessments as natural gas exploration and production accelerates. Understanding the implications of these issues is critical to protect sources of water used for drinking and to sustain ecosystem health in streams, lakes, and reservoirs.

This edition of NDWRRI Newsletter brings news of the activities of the Institute during 2011-12. Overall, it has been a great year during which several NDWRRI Graduate Fellowship projects produced or heading towards producing important results.

In this issue, 2012 NDWRRI Fellowship recipients are introduced and last year's Fellowship research projects are highlighted. Highlights of WRRI-affiliate faculty research groups are also presented. We 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.

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 available 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 Second Annual NDWRRI Distinguished Water Seminar and a brief description of the event can be found in this issue. The Institute also partnered with ND Department of Health, USGS and ND State Water Commission in organizing the North Dakota Water Quality Monitoring Conference in Bismarck, ND.

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 setting Institute's research priorities and reviewing Fellowship applications.

G. Padmanabhan, Director
North Dakota Water Resources Research Institute
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Inside this issue:

The Institute Awarded Thirteen Graduate Fellowships for the Year 2012-2013

Fellow: Alex Stalboerger

Title: Constructed Wetlands for Treatment of Tile-drainage Water and for Production of Biofuel

Advisor: Marinus Otte, Wet Ecosystem Research Group, Biological Sciences, NDSU

Fellow: Justin Fisher

Title: Integrating Life Stage Habitat Into Landscape Genetics model for the Conservation of a Declining Amphibian Species

Advisor: Craig Stockwell, Biological Sciences, NDSU

Fellow: Anusha Balangoda

Title: Studies of Seasonal Succession of Cyanobacteria and Green algae Heinrich-Martin Impoundment, North Dakota

Advisor: Wei Lin, Civil Engineering, NDSU

Fellow: Kate Overmoe-Kenninger

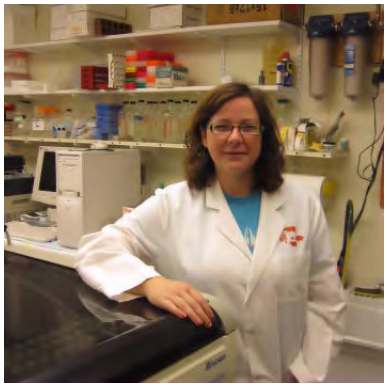
Title: Assessment of Water Quality in Devils Lake using Satellite Imagery

Advisor: Xiaodong Zhang, Earth Systems Science, UND

Fellow: Atikur Rahman

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

Advisor: Shafiqur Rahman, Ag & Biosystems Eng, NDSU



Fellow: Katrin Chambers

Title: Quantifying Estrogens Bound to Soil and Manure Colloids and Assessing Their Bioavailability

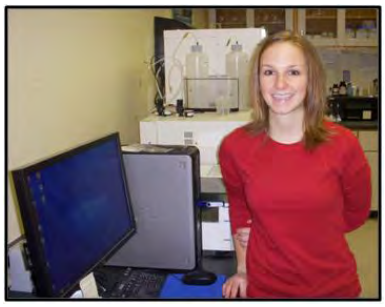
Advisor: Francis Casey, School of Nat Res Sciences, NDSU

Fellow: Hasin Shahad Munna

Title: Advancing Hydrologic Simulations and Flood Frequency Analysis of Devils Lake Under Climate Change Scenarios

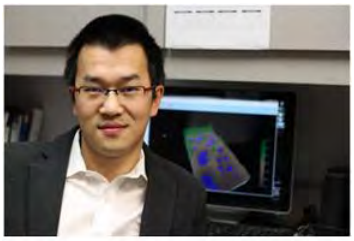
Advisor: How Lim, Civil Engineering, UND

Fellow: Leslee Storlie



Title: Investigation of Bromate Formation in Ozone Disinfection Systems Through Comprehensive Sampling, Water Quality Analysis, and Model Simulation

Advisor: Wei Lin, Civil Engineering, NDSU



Fellow: Jun Yang

Title: Toward Understanding the Hydrologic Processes on Topographic Surfaces with Depressions—Development of a Physical-bases Distributed Puddle-to-Puddle (P2P) Hydrologic Model

Advisor: Xuefeng Chu, Civil Engineering, NDSU

Fellow: Veselina Valkov

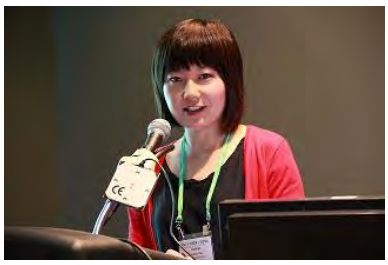
Title: Temporal-spatial Distribution (Dynamics) Diversity in Relation to Lake Physical and Chemical Condition

Advisor: Wei Lin, Civil Engineering, NDSU

Fellow: Tanush Wadhawan

Title: Role of Agricultural Drainage on Transport of Cryptosporidium Oocyst In North Dakota

Advisor: Eakalak Khan, Civil Engineering and John McEvoy, Vet & Micro, NDSU



Fellow: Xuelian Bai

Title: Sorption, Degradation, and Mobility of 17ß-Estradiol-17Sulfate in Agricultural Soils

Advisor: Francis Casey, School of Nat Res Sciences, NDSU

Fellow: Michael Quamme

Title: Selenium Removal from Surface and Groundwater Using Iron Nanoparticles

Advisor: Achintya Bezbaruah, Civil Engineering, NDSU

Upcoming Events

National Water Resources Association's Western Water Seminar, Sun Valley Resort, Sun Valley, ID, August 01-03, 2012. http://www.nwra.org/events/2012/8/western-water-seminar-2/

EWRI Hydraulic Measurement and Experimental Methods Conference, Snowbird, Utah, August 12-15, 2012. http://content.asce.org/conferences/HMEM2012/index.html

2012 Distribution Systems Symposium & Exposition and Water Security and Emergency Preparedness Conference & Exposition, St. Louis, MO, September 9 – 12, 2012
http://www.awwa.org/Conferences/SpecConf.cfm?ItemNumber=50778&navItemNumber=50780

2012 Montana Section AWRA Conference, "Montana's Water Resources: Water Management in the Face of Uncertainty", Fairmont Hot Springs, Fairmont, Montana, October 11-12, 2012. http://state.awra.org/montana/conference/conference_2012.htm

The 7th Annual Eastern South Dakota Water Conference, South Dakota Water Resources Institute, South Dakota State University, Brookings, South Dakota, October 30, 2012.

2012 Water Quality Technology Conference and Exposition (WQTC), Toronto, Ontario, Canada, November 4-8, 2012
http://www.awwa.org/Conferences/wqtc.cfm?ItemNumber=32120&navItemNumber=3545

2012 AWRA Annual Water Resources Conference, Jacksonville, FL, November 12-15, 2012.
http://awra.org/meetings/Jacksonville2012/

2011 — 2012 NDWRRI Fellowship Research Highlights

Andrea Hanson: Uptake and effects of environmental estrogens on growth of fish

The findings of this project will advance our understanding of Environmental Estrogens (EE) uptake and metabolism, and for the first time establish whether or not these agents act as endocrine disruptors of growth in wide-ranging aquatic species. While this work pertains specifically to rainbow trout, because the elements of the GH-IGF-1 system are highly conserved among vertebrates, the findings will have broad relevance to understanding the impact of EE in other aquatic and terrestrial species.

Anusha Balangoda: Studies of Seasonal Succession of Cyanobacteria and Green algea Heinrich-Martin Impoundment, ND

In this project, water samples were collected on biweekly schedule at each of the four selected sites throughout the summer 2010. The samples were taken at four depths: 0.5m from the surface, secchi depth, two times secchi depth, and 0.5m from the bottom, at each site. Water samples were analyzed for nutrients (NH4+, NO3 -, NO2-, TP, SRP, TN, and Org P), chl-a, TSS, VSS, and phyto-plankton counting and identification. During the sampling period, the calibration methods for several analytical tools (e.g., UV/ Visible spectrophotometer, YSI multi parameter sonde, and Turbidity meter) were developed. Procedures for nutrients analyses (NH4+, NO3 -, NO2-, TP, SRP, TN, and Org P), analyses for TSS and VSS, and chlorophyll -a were developed. Further, procedures for phytoplankton counting and identification were also developed successfully.

Brianna Schneck: Source Tracking of Cryptosporidium in Rural Watersheds

Small mammals are hosts to various genotypes of Cryptosporidium. Brianna found Cryptosporidium species or genotypes in over 42% of our samples. In more than 600 samples the prevalence is approximately 40%. At least 14 Cryptosporidium genotypes/species in 10 wildlife host species were identified. A novel genotype of Cryptosporidium was found in Eastern chipmunks. Further molecular characterization and microscopic analysis are in progress. Two species of Cryptosporidium, C. parvum and C. ubiquitum, are considered human pathogens, and were found in a number of wildlife samples.

Sita Krajangpan: Arsenic Contaminated Groundwater Remediation by Entrapped Nanoscale Zero-Valent Iron

This project explored aqueous arsenic removal using nanoscale zero-valent iron (NZVI) entrapped in calcium (Ca) alginate beads. The results from this study show great promise for entrapment technique as an advanced treatment technique for aqueous arsenic. Arsenic is a serious threat to human health and millions of people are affected by arsenic contamination in various parts of the world including the United States. The entrapment process reduces mobility of the nanoparticles by confining them within the polymer matrix and, thus, reducing the risk of post-treatment hazard by arsenic sorbed onto NZVI. Ca-alginate polymer is an excellent choice as an entrapment medium as it is non-toxic and has little solubility in water. In bench scale batch studies with initial As(V) concentrations of 1-10 mgL-1, ~ 80-100% arsenic removal was achieved within 2 hours. While the reaction kinetics differ between bare and entrapped NZVI, the overall reductions of arsenic are comparable. Surface normalized arsenic reduction reaction rate constants (ksa) for bare and entrapped NZVI were 3.40-5.96x10-3 and 1.90-4.43 x10-3 L m-2 min-1, respectively.

Rabiya Shabnam: Plant-based Biopolymers for Entrapping Metal Nanoparticles for Arsenic Removal: Biodegradation and Treatability Studies

The results of this project indicate that polysiloxane-polyethylene glycol-carboxylic acid based synthetic copolymers do not degrade easily but degrade faster in the presence of NZVI. A soybean oil based copolymer used in this study showed complete and fast degradation with and without NZVI. This fellowship research has used a new robust method to evaluate biodegradability of polymers and polymer coated NZVI. The new method uses respirometric techniques and acquires biochemical oxygen demand data continuously from the aqueous samples containing polymer or polymer coated NZVI.

Hasin Shahad Munna: Flood Risk Assessments of Various Scenarios for Devils Lake under GCM Downscaling Simulations Using a Coupled Hydro-Climatic Model Incorporating Recent Advances in Lake Evaporation Estimations

Devils Lake in North Dakota receives surface runoff from 3,810 square miles of drainage basin. The uncontrolled growth of the lake has been an alarming issue for North Dakota for the last few years. The on-going lake flooding is both unique and complex. In this study, a hydro climatic model has been developed to estimate the lake behavior for a 20 to 50 year time period. The watersheds that feed directly into Devils Lake were modeled using Arc-GIS and imported into HEC HMS model to simulate the run-off to the Devils Lake. Then the run-off time series was imported into HEC-ResSim model to estimate the lake levels which was calibrated with observed elevations. The calibration was done for the years of 2001 to 2004. The combined physical properties (Elevation-Storage-Area) were used to model the lake as during our study period the elevation of the lake was consistently over 1447 ft amsl. Now the research group is working on combining all the individual run-off sub-models into a single model which will then be coupled with the calibrated HEC-ResSim to permit simulations of the future time periods.

Justin Fisher: Integrating life stage habitat into landscape genetics model for the conservation of declining amphibian species

This research is very timely due to the recent efforts to list the northern leopard frog in the Endangered Species Act. Managers are seeking genetic data to help identify regions/populations that should be included in the listing. This research extends standard landscape genetic models to incorporate important spatial and temporal distribution of drought refugia sites to produce more robust models needed to understand long-term population structure of northern leopard frogs. This research could contribute valuable insights for state and federal managers as they consider the petition for listing the northern leopard frog under the Endangered Species Act.

Kate Overmoe-Kenninger: Assessment of Water Quality in Devils Lake Using Statelite Imagery

Water quality issues have become an ever-increasing concern of the nation. Therefore, it has become necessary to establish water quality monitoring to protect the nation's waterbodies. Measurements of water quality using traditional methods in the field can give accurate measurements but are not always accessible or convenient. In addition, high costs of ground monitoring typically results in the favoritism toward fewer lakes for more frequent sampling and thus limits the spatial coverage of an area. Landsat images are useful in inland lake water quality monitoring due to temporal coverage, spatial resolution, and data availability. In this project, historical water quality data (SDT, chl-a, total P, and turbidity) and data locations within all North Dakota lakes and reservoirs have been obtained from the EPA STORET, EPA Legacy, and USGS databases. Corresponding Landsat scenes and acquisition dates have been identified and image processing is currently in progress. The first field season in the Devils Lake basin was completed in 2011, with a total of six sampling dates corresponding with Landsat overpass from June to October. In addition, this was the first season deployment of a water quality monitoring buoy in Stump Lake. The buoy measured, recorded, and transmitted data on salinity, transparency, total dissolved solids, oxygen concentration and chl-a concentration every 10 minutes for 77 days.

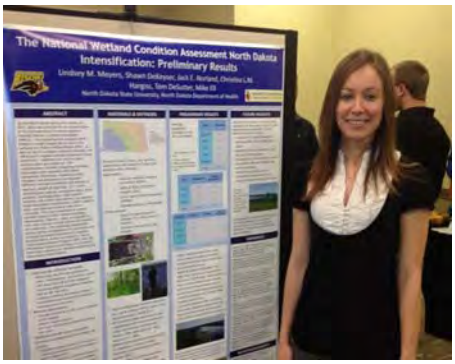
Katrina Chambers: Bioavailability of Dissolved and Colloidal Organic Carbon Bound Estrogen

The natural estrogen, 17ƒÒ-Estradiol (E2), is the most potent endocrine disrupting compound. The issue of reproductive hormones in the environment is of particular relevance to animal agricultural because of the association of hormone detections with manure management practices. Natural hormone concentrations have been detected in runoff and receiving surface waters as a result of field manure application. Reproductive hormones have also been measured in subsurface waters in proximity to intensive livestock production. A preliminary survey of ELISA responses to various preservatives, E2 concentrations, and DOC/COC concentrations has been conducted. Results may indicate that E2 bound to DOC/COC can still interact with the hormone receptors and induce an estrogenic response. E2 Association/Dissociation with COC: The results from the ultrafiltration of the swine lagoon manure spiked with radiolabeled E2 show that E2 is associated with COC partials and that E2 can be dislodged from the COC particles when rinsed with water. The environmental implication of these finding is that E2 can "hitch-hike" on COC partial to be distributed in the environment and be dislodged potentially as free estradiol. Reverse and normal phase Thin Layer Chromatography (TLC) has been done on the COC fraction of liquid swine manure. The result show that the radiolabelled E2 bound associated with the COC fraction does not behave like a molecule but more as a particle. Specifically, the COC fraction did not respond to chromatographic separation because the radioactivity stayed at the origin of both the normal and reverse phase TLC. This indicates that the 14CE2 associated with the COC is acting like a particle and not like a molecule. The results from the Estrogen Receptor (ER) competitive –binding assays show that there is an estrogen response induced by the E2 associated with the COC fraction.

Kyle Hafliger: Techniques of Assessing Changes in River Flooding Patterns in the Upper Midwest

The Upper Midwest has generally been in a wet cycle since 1993. This has caused increased flooding in rivers and streams. Eight different rivers were chosen to analyze the annual peak flows during the period of record. In the Midwest, the James River had a significant increase in the average annual peak flow since 1970. The time period from 1971 to present has over twice the value for the average annual peak flow compared to the time span of 1929 through 1970, a bigger change than any other river analyzed to find changes. Therefore, the James River Basin was chosen for further study. The method used to find the magnitude of change in the mean annual peak flow during two specific time periods is the two tailed t-test. The two time periods used was from the period prior to 1970 and the period from 1971 to present. The rivers or streams that were chosen for analyzing were ones that had a P value of less than 0.05 from the two tailed t-test result. The lower the value of P, the bigger change that has occurred in the peak annual flows. Of the rivers researched in the Upper Midwest, only two had P values under 0.05: the Thief River at Thief River Falls, Minnesota, and the James River at Scotland, South Dakota. The James River had the lowest P value. The daily flow data was analyzed for each of the rivers that had a significant change in the annual peak flows to look at the flood changes in more detail. A wavelet analysis using MATLAB of daily flows in the James River, at the Scotland, South Dakota station, showed an increase in flooding frequency starting around 1960.

Lindsey Meyers (Malum): Ecosystem Services and Wetland Condition Assessment in the Prairie Pothole Region



This study seeks to assess and evaluate wetlands across the state of North Dakota with a special emphasis on wetlands in the Prairie Pothole Region (PPR). In the summer of 2011, four assessment and nutrient studies were completed on 55 wetlands. The National Wetland Condition Assessment (NWCA) evaluated vegetative, soil, water, algal, hydrological and buffer wetland characteristics. The NWCA not only included intensive sampling of these biological and physical criteria, but also included a rapid assessment of these criteria. Regional wetland assessments developed for North Dakota were also completed at each site. Each wetland was rapidly assessed using the North Dakota Rapid Assessment Method (NDRAM), plant community composition of each wetland was evaluated using the Index of Plant Community Integrity (IPCI), and functional characteristics of the wetlands were evaluated using the Hydrogeomorphic (HGM) model. At each wetland, live plant and soil samples were collected for nutrient analysis. Currently, data entry and analysis, statistical analyses, and lab analyses are being performed on data and samples collected during 2011.

Mohammed Mizanur Rahman: Hydrologic Adaptiation of SWAT Model for Snow Dominated and High Groundwater Table Conditioned Watersheds and Scenario Analysis of Impacts of Tile Drainage on Stream Flow

No specific research has been done in the past to parameterize the SWAT model for the impact analysis of tile drainage in the Red River basin of the North. Objectives of this study are 1) to optimize the hydrologic parameters of SWAT model for snow dominated watersheds of North Dakota 2) To identify the most sensitive parameters that must be paid extra attention during formulating any water management strategies for this region and 3) scenario analyses of probable future impacts of tile drainage in stream flow in the Red River of the North basin.

Collection and processing data for the Red River of the North Basin on topography, land use, soils, meteorology, hydrology, and water quality have been completed. SWAT model was successfully set up and calibrated for the Western Wild Rice River watershed. A method for mapping the existing tile-drained areas in the upper Red River basin is being developed.

Sharanya Shanbhogue: Co-entrapment of Iron Nanoparticles and Tricholoroethylene Degrading Bacteria in Alginate Bopolmer for Groundwater Remediation

The main objective of this study is the co-entrapment of Nano scale Zero Valent Iron (NZVI) and Trichloroethelene (TCE) degrading bacteria in alginate polymer to achieve complete degradation of TCE in groundwater. Alginate capsules have been synthesized and NZVI was successfully encapsulated. Diffusion and treatability studies using encapsulated NZVI was performed for varying concentrations of TCE. Microorganisms were encapsulated and used for TCE degradation. Encapsulated NZVI, microorganisms, and the combined metal-microorganism system were found to be effective for TCE degradation. The project is on-going using different strains of microbes to test the efficacy of the combined metal-microorganism system.

Tanush Wadhawan: Role of Agricultural Drainage on Transport of Cryptosporidium Oocysts in North Dakota

The sources for Cryptosporidium can be humans or animals; however, the understanding of a relationship between the source and disease transmission is limited. The main objective of this project is to investigate the role of agricultural drainage system on transport of Cryptosporidium in North Dakota. The specific objectives are: 1) To investigate adsorption and desorption of Cryptosporidium parvum on the soils obtained from agricultural fields in North Dakota. 2) To determine the effects of agricultural drainage systems on the transport of Cryptosporidium parvum through the soils obtained from agricultural fields in North Dakota by simulating subsurface tile drains in a soil box and 3) To study the transport of Cryptosporidium found in the manure applied to a subsurface drained agricultural field in North Dakota. This research is expected to demonstrate for the first time the role of agricultural drainage system on the transport of Cryptosporidium. It will greatly benefit North Dakota in identifying possible sources of cryptosporidiosis outbreaks. The data generated can be used for risk assessment and development of control practices which will benefit public health.

Veselina Valkov: Temporal-spatial Distribution of Phytoplankton and Diversity in Relation to Lake Physical and Chemical Condition

Eutrophication as a result of anthropogenic input of nutrients especially phosphorus and nitrogen, is a surface water quality concern, for North Dakota lakes and reservoirs. The increased input of nutrients causes excessive and rapid growth of phytoplankton. Biological productivity is high and the diversity of biological populations may be limited. The goal of this project is to expand existing research on water quality of the eutrophic impoundment of Henrich Martin Dam, North Dakota. The scope is to understand how variation in physical and chemical disturbances influence spatial - temporal phytoplankton distribution and diversity and can cause shifts in changes in community patterns. In this study, ten classes were identified, dominated of which were Bacillariophyceae, Dinohyceae, Chryptophyceae, Cyanophyceae and Chlorophyceae. The changes in the temperature, duration of the day and nutrient supply led to the succession sequence. At the beginning of June Bacillariophyceae was dominant class in terms of species numbers, density and biomass. Later in summer the Dinophyceae starts to be a dominating class. Class Chrysophyceae characterized with occurrence of mixotrophy was found once in June 2010 and in August and September in 2011, probably due to their requirements for high water temperature or nutrition supply. The period between these two dominant classes is characterized with more diversity between groups. Unexpected under Nitrogen limited condition class Cyanophyceae in 2010 contributed no more than 11% from the total abundance in summer, while in 2011 was 76%, in spite of aeration system still worked. The population of Cyanophyceae collapsed three weeks after aeration was stopped. Potential explanation include acceleration of buoyancy-induced vertical migration rates, protection against photo inhibition, reduce grazing losses, high oxygen, that could inhibit which could potentially inhibit nitrogenaze activity, exposure to the nutrients and turbulence. The population continued to decrease and was replaced by Dinoflagellate.

Featured Research

Water Resources Engineering
By Howe Lim, Civil Engineering, UND

Dr. Yeo Howe Lim has been actively pursuing research in water resources engineering since 2003 at the University of North Dakota. He has supervised to completion on average one graduate student per year since 2003 working in the water resources engineering area. Research grants from NASA, North Dakota State Water Commission, North Dakota Water Resources Research Institute, Red River Regional Council, and ND-EPSCoR support his research involving flood frequency analysis, hydro-climatic modeling, physical hydraulic modeling, and pipe network analysis. One significant research involves hydro-climatic modeling of Devils Lake under projected climatic conditions using regional downscaling of GCM. Part of the findings was presented at the 2012 World Environmental and Water Resources Congress. Dr. Lim's group also conducted two separate hydraulic studies using physical models mounted on a large tilt-adjustable research flow flume at UND's Hydraulic Laboratory. An undergraduate student designed and constructed flow flume over two summers.

He led four of his students to present their technical papers at 2012 World Environmental and Water Resources Congress held at Albuquerque, New Mexico (May 20 – 24), organized by Environmental and Water Resources Institute of the American Society of Civil Engineers. Hasin Munna, one of Dr. Lim's graduate students and also a NDWRRI fellowship recipient, received 2nd place award in the Graduate Student Technical Paper Competition at the congress. The paper is titled "Development of a Temperature-based Model to Simulate Evaporative Losses over Water Bodies in Cold Regions."

Fate of estrogenic hormones in the water environment
By Francis Casey, School of Natural Resources Sciences, NDSU

Estrogenic hormones from anthropogenic and livestock sources have drawn considerable concern and debate regarding their potential impacts on the environment and human health. Studies on the feminization of male fish near wastewater treatment plants or the collapse of a fish population in an experimental lake have fueled this debate. Aquatic organisms can be affected by natural and synthetic estrogens at concentrations around 10 parts per trillion. Moreover, the widespread detection of estrogens in the environment has heightened the urgency to understand their fate and transport.

For over a decade Dr. Francis Casey, his students, and USDA-ARS (Animal Metabolism- Ag. Chemical Unit; Fargo, ND) collaborators have studied the issue of hormones in the environment. Several of Dr. Casey's students who studied this issue were WRRI Fellows. These researchers have been trying to answer the question of how hormones enter the environment and what their fate is once they enter the environment. Their laboratory research was some of the first to show hormones readily and strongly bind to soils and sediments and that hormones are very short-lived. Nonetheless, their field studies demonstrate widespread detections and significant mobility of hormones.

Recent research from this group has focused on understanding how short-lived, immobile hormones are widely detected in the environment. Their recent focus has been on colloidal and dissolved organic matter that may facilitate hormone persistence and mobility. They have found that dissolved and colloidal organic matter derived from soil and swine manure can enhance hormone mobility and persistence in the laboratory.

Also, these researchers are looking at the influence of hormone conjugates on the persistence and mobility of hormones in the environment. Excess hormones are eliminated from the body in urine primarily as conjugates. Conjugates moieties of sulfate or glucuronic acid are attached to the hormone steroidal structure and allow these insoluble compounds to be dissolved in urine or bile and shed from the body. Past research has not focused on hormone conjugates and the NDSU research group has provided some of the first results of how conjugates may influence the overall fate and disposition of hormones in the environment.

National Wetland Condition Assessment (NWCA): A multi-agency collaborative effort
By Edward Dekeyser and Linsey Meyers, Natural Resources Management, NDSU

In 2011, the National Wetland Condition Assessment (NWCA) was completed nationwide. This was a multi-agency collaborative effort. North Dakota State University, the Environmental Protection Agency (EPA), the North Dakota Department of Health (NDDoH), the Natural Resource Conservation Service (NRCS), and the Department of Agriculture were key collaborators for the state of North Dakota. The original sample size for the project was 11 wetlands, but this was enlarged to represent the wetland-rich prairie pothole region. Our research group led the effort completing the North Dakota project visiting 55 wetland sites with 2 revisits. We are also further collaborating with the Western Ecology Division of the EPA in Corvallis, OR with nitrogen isotope analysis and modeling in wetland soils.

In addition to completing the NWCA methods at each wetland, three regional wetland assessments were also completed: Index of Plant Community Integrity (IPCI), North Dakota Rapid Assessment Method (NDRAM), and Hydrogeomorphic (HGM) Model. Plant and soil samples were collected within the wetland catchment for nutrient analysis. Plant samples were collected for nitrogen, phosphorus, and carbon analysis and soil samples were collected for phosphorus and mercury analysis. This summer, the three regional assessments and plant and soil samples are being collected at wetlands that have had sediment removal. This will be another aspect of the project studying possible management techniques that help decrease hybrid cattail (*typha* x *glauca*) invasion.

Within the next two years field sampling, data and sample analysis, and statistical analysis will be completed. The wetland assessments and nutrient results will be analyzed and compared. A detailed analysis and assessment of North Dakota wetlands will be completed. This will assist in further wetland assessment and monitoring in the future as well as a look into nutrient status and behavior in wetlands. This will also provide detailed data of land use, water quality, plant species, and hydric soils across the state.

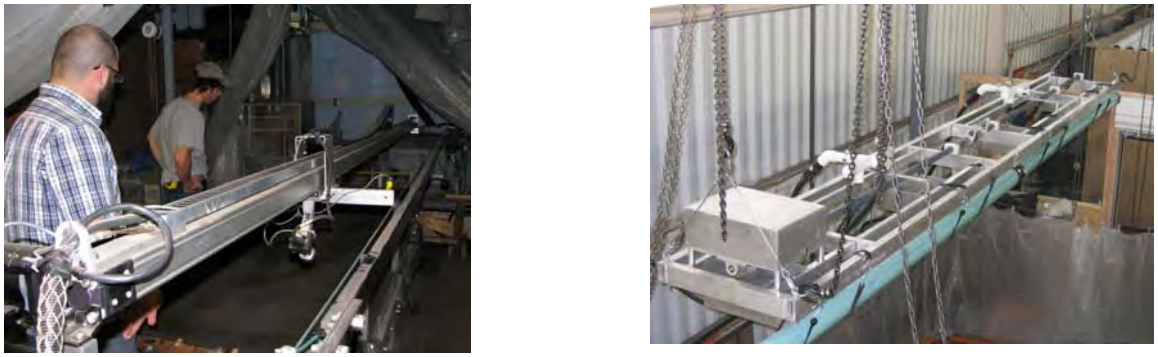
Surface Microtopography, Overland Flow, & Threshold Behaviors

By Xuefeng Chu, Civil Engineering, NDSU

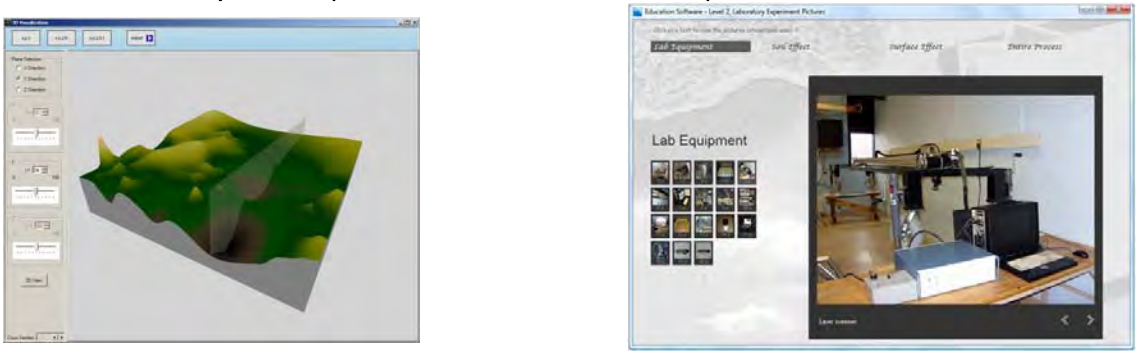
Surface topography affects a series of hydrologic processes across scales, such as infiltration, overland flow generation, surface runoff, soil erosion, and sediment transport. Due to the existence of surface depressions, a hydrologic system often exhibits threshold behaviors. Effective characterization of surface microtopography and improved understanding of the puddle-to-puddle (P2P) filling-merging-spilling overland flow dynamics and the threshold-driven processes are of particular importance to watershed hydrologic and environmental modeling. An overland flow laboratory has been set up in the Civil Engineering at North Dakota State University by Dr. Xuefeng Chu. Both experimental and modeling studies have been conducted to characterize surface microtopography and simulate the puddle-to-puddle (P2P) overland flow processes and the related threshold behaviors by Dr. Xuefeng Chu and his research group of graduate students.

The P2P experimental work focuses on examining threshold overland flow and spatio-temporal variability in infiltration and unsaturated flow under varying microtopography, rainfall, and soil conditions through a series of lab-scale overland flow experiments. An instantaneous-profile laser scanner is used to acquire high-resolution DEM data that are further used for automated surface delineation. A four-head Norton style rainfall simulator is utilized to generate rainfall for the lab experiments. In addition, larger scale overland flow experiments also have been conducted for different field plots. The experimental study has demonstrated the threshold-driven overland flow processes and the significant influence of surface microtopography on overland flow generation, infiltration, and unsaturated flow.

In the modeling effort, a comprehensive P2P modeling system has been developed, which integrates computer modeling, hydrotopographic analysis, visualization techniques, and hydrologic education in a user-friendly Windows interface. The Windows-based P2P software consists of the P2P-Model, P2P-Tool, and P2P-Education systems. Based on surface puddle delineation, the P2P-Model simulates the dynamic P2P filling, spilling, merging, and separating overland flow processes. Particularly, the wizard facilitates computer-guided, step-by-step P2P modeling. The P2P-Tool includes a set of stand-alone tools for visualization and hydrotopographic analyses, such as 2D/3D visualization and animation, puddle delineation (PD), image-based depression storage computation, and fractal analysis. The PD tool, as an essential component of the P2P modeling, is used for characterizing surface microtopography, delineating puddles and their relationships, determining flow directions and accumulations, and precisely computing maximum depression storage, maximum ponding area, and other topographic parameters. The P2P-Education system is specially designed for three major user levels: elementary level (Level 1: K-12 and outreach education), medium level (Level 2: undergraduate education), and advanced level (Level 3: graduate education). The education software features a series of movies, pictures, and documentation related to fundamental theories, experiments, and modeling of overland flow generation, surface runoff, and infiltration processes under the influence of surface microtopography.



P2P Experiments (laser scanner and rainfall simulator)



P2P Modeling System (Main Windows interface of the P2P software and 3D tool)

Dr. Xuefeng Chu's research group doing the field work to prepare experimental runoff plots

Nanoenvirology Research Group

By Achintya Bezbaruah, Department of Civil Engineering , NDSU

Members of Nanoenvirology Research Group (Summer of 2012). From L to R: Mary Pate, Hodan Ahmed, Andrea Meyer, Mohamed Said, Seydou Cisse, Achintya Bezbaruah, Michael Quamme, Harjyoti Kalita, Talal Almeelbi, and Bryant Feist lin the front). Not in the picture: Rabiya Shabnam, Sita Krajagpan, Sharnya Shabhogue, Steve Jensen, Kristal Gruba, and Amy Schaaf.

Nanoenvirology Research Group (NRG) is spearheading North Dakota State University's (NDSU) environmental nanotechnology research from a life-cycle perspective. With his groundwater remediation experience with a leading consulting firm, Dr. Achintya Bezbaruah, Assistant Professor of Civil Engineering at NDSU, started NRG in 2005. Nanotechnology is an emerging area that deals with materials which are smaller than 100 nm at least in one dimension. Nanomaterials have amazing phyico-chemical properties not found in their bulk counterparts, and these unique properties have made nanomaterials immensely popular in biomedical applications, sensing, electronics, consumer products, and paint industry. Nanotechnology is said to be 'the next big thing' after industrial revolution and the advent of electronics. Fortunately, researchers are acting proactively to look into the darker side of nanotechnology which was not the case with industrial revolution and electronics. NRG researchers at NDSU experiment with greener production of nanomaterials, looking into impacts of various nanomaterials on ecosystem components, and developing novel technologies for contaminant removal using nanotechnology. Starting with a couple of students in 2005, the group now has fifteen students researchers working on various topics related to environmental nanotechnology.

This new area of research needs multi-disciplinary problem solving approach and collaborations with other researchers. NRG has collaborations within Civil Engineering, NDSU, and outside. Dr. Bret Chisholm from NDSU's Center for Nanoscale Science and Engineering has been working with NRG members and co-advising two doctoral students with Bezbaruah. NDWRRI fellows Sita Krajangpan and Harjyoti Kalita are working on the development of new polymeric surface modifiers to coat nanoscale zero-valent iron (NZVI) for efficient delivery of zero-valent iron into the aquifer for effective groundwater remediation. Further, NRG's collaboration with Wetland Ecology Group of Drs. Marius Otte and Donna Jacob has led to a joint study on titanium nanoparticle and plant interactions. With Drs. Eakalak Khan, John McEvoy, and Senay Simsek, Bezbaruah's group is exploring interactions of NZVI with endemic microorganisms and encapsulation of NZVI/microorganisms in biopolymer beads and capsules.

With an extensive set of the research data, patents, and publications, the group has been successful to get two major research grants in addition to NDWRRI fellowship grants. The two-year $175,000 National Science Foundation (NSF) grant has Dr. Bezbaruah as the sole investigator. NRG members Talal Almeelbi, Michael Quamme, Mary Pate, Seydou Cisse, and Rabiya Shabnam are exploring the possible uses of biopolymers for the surface modification of NZVI for contaminant removal and resource recovery. Target contaminants in this NSF research are phosphate, selenium, sulfate, arsenic, and ***trichloroethylene. One of emphases of this work is to examine the bioavailability of some of the nutrients and micronutrients adsorbed onto the nanoparticles. The other major grant to Bezbaruah as the principal investigator is on food safety (***vis-à-vis nanomaterials). The interdisciplinary and inter-institutional team for this project include Drs. Kalpana Katti, Marinus Otte, Dinesh Katti, and Donna Jacob from NDSU, and Dr. Jose Gonzalez from South Dakota State University. The three-year $500,000 National Institute of Food and Agriculture (NIFA)/ United State Department of Agriculture (USDA) grant will investigate plant-nanoparticle interactions at molecular level. The plant species to be studied in this NIFA-USDA project are rice and spinach, and nanomaterials selected are zinc oxide and carbon nanotube.

For the graduate students, work at NRG is a rich experience as they not only work on their own research but also mentor undergraduate and K-12 students in nanotechnology research. Such collaboration and mentorship have led to high quality research at NRG. One of the undergraduate students (Juan Elorza) has the unique distinction of being one of the co-authors of a major journal paper. Steven Jensen, Kristal Gruba, and Amy Schaaf are the present undergraduate students involved in nanotechnology research. Four students from West Fargo High School are presently working alongside the graduate students and exploring frontiers of nanotechnology. NRG is also playing a role in helping students pursue higher studies at renowned universities; Jay Thompson who worked for his masters with Bezbaruah and a NDWRRI Graduate Fellow will be graduating from Stanford University in 2013. Most of the graduate students in NRG are recipients of NDWRRI fellowships while Seydou is a Fulbright Scholar and Talal has a fellowship from Saudi Arabia.

Nanoenvirology Research Group members also volunteer their time for outreach activities which include planning and implementation of nanotechnology teaching modules for the seventh grade students at West Fargo STEM Middle School, and offering hands-on introductory classes on nanotechnology ("Nano…Nano…") for elementary and middle school students at Marketplace for Kids. The primary objective of the outreach programs is to entice young students to higher studies and careers in science, technology, engineering, and mathematics (STEM).

The Wet Ecosystem Research Group at NDSU

By Donna Jacob and Marinus Otte, Department of Biological Sciences, NDSU

The Wet Ecosystem Research Group (www.ndsu.edu/werg) at North Dakota State University is supervised by Dr. Donna Jacob and Dr. Marinus Otte in the Department of Biological Sciences. Most of the work focuses on plant soil interactions in wetlands, with an emphasis on biogeochemistry of metals. The research not only aims to study the mechanisms underlying mobility and uptake in plants of metals and other elements, but also uses multi-element analysis as an assessment tool for ecosystem functioning and services.

In addition to Jacob and Otte, the research group currently includes one postdoctoral fellow, Dr. La Toya Kissoon, one Ph.D. student (Carrie Karki-Werkmeister), three M.S. students, Alex Yellick, Aida Asgary, and Alex Stalboerger, and many undergraduate students. The latter volunteer or receive credits or some financial support from grants. Some undergrads volunteer for a few months during one semester, others, such as Ryan Sullivan and Josh Borchardt work with the group for several semesters, or even years. As a result Ryan is in the final process of preparing a paper about his research the relationship between turbidity of shallow lakes and fringe vegetation in MN shallow lakes (together with Dr. La Toya Kissoon), while Josh is a co-author on a paper on uptake of nanoparticles in wetland and other plants. Alex Yellick started as a volunteer undergrad student in the research group and is now pursuing his M.S. on the use of multi-element 'fingerprints' in prairie pothole wetlands as an assessment tool for ecosystem quality and integrity.

The research is funded by several agencies, including NIH (NDINBRE, see http://ndinbre.org/), EPA (Wetland Program Development Grant, and 'Section 319'), NASA (as part of the Upper Midwest Aerospace Consortium, see http://www.umac.org/), and the ND Water Resources Research Institute. Past funding from NDWRRI involved a project studying multi-element fingerprinting as a tool to identify and quantify sediment sources in ND rivers. A report of that work, which was carried out by Dimuthu Wijeyaratne, can be found on the NDWRRI site at http://www.ndsu.edu/wrri/2010_11%20ANNUAL%20REPORT1.pdf (page 17).

Current support from NDWRRI is for the M.S. project of Alex Stalboerger. This work investigates the efficacy of a constructed wetland at the Embden Discovery Farm to improve the quality of tiledrain water (Figure 1). Such waters in the region are typically high in sulfate. Constructed wetlands, designed to induce anaerobic conditions in the substrate, will convert sulfate to sulfide, which then either vents from the system as hydrogen sulfide gas or precipitates as metal sulfides. Because these sulfides mobilize phosphate, a second, aerobic cell is needed to remove phosphates before the water is discharged. At least, that is the theory. How it works in the conditions prevailing at the site remains to be seen.

The constructed wetland at the Embden Discovery Farm (May 2012). The system was constructed in 2011. The emergent helophytes, cattails (Typha latifolia), have yet to emerge. The banks of the system host fast-growing willow (a hybrid known as QC83, which grows 3 m/yr) for production of biogasification fuel (photo by Alex Stalboerger).

Recent Publications and Presentations by Institute Fellows and PIs

Journal Papers

Hanson, A., Kittilson, J.D., McCormick, S.D., **Sheridan, M.A.**, 2011 (in press) Effects of 17β-estradiol, 4- nonylphenol, and β-sitosterol on the growth hormone-insulin-like growth factor system and seawater adaptation of rainbow trout (Oncorhynchus mykiss). Aquaculture.

Jacob DJ, Borchardt JD, Navaratnam L, **Otte ML, Bezbaruah AN** (in press) Uptake and Translocation of Ti from Nanoparticles in Crops and Wetland Plants. International Journal of Phytoremediation DOI:10.1080/15226514.2012.683209

Krajangpan, S.; Kalita, H.; Chisholm, B.; Bezbaruah, A.N. Iron Nanoparticles Coated with Amphiphilic Polysiloxane Graft Co-polymers: Dispersibility and Contaminant Treatability, Environmental Science & Technology, Accepted for publication, DOI: 10.1021/es3000239, 2012

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

Bezbaruah, A.N.; Shanbhogue, S.S.; Simsek, S.; **Khan, E**. Encapsulation of Iron Nanoparticles in Alginate Biopolymer for Trichloroethylene Remediation, Journal of Nanoparticle Research, 13:6673-6681, 2011.

Kasi, M., McEvoy, J., Padmanabhan, G., and Khan, E. (2011) Groundwater Remediation Using Enricher Reactor - Permeable Reactive Biobarrier for Periodically Absent Contaminants. Water Environment Research, 83(7), pp. 603-612.

Suman L. Shrestha, Xuelian Bai, David J. Smith, Heldur Hakk, **Francis X. M. Casey**, Gerald L. Larsen, and **G. Padmanabhan** (2011) Synthesis and Characterization of Radiolabeled 17β-estradiol Conjugates, Journal of Labelled Compounds and Radiopharmaceauticals, 2011, 54, 64. Also published online in Wiley Online Library, DOI: 10.1002/jlcr.1864

Melesse, A.M., Ahmad, S., McClain, M.E., Wang, X., **Lim, Y.H.** (2011) Suspended Sediment Load Prediction of River Systems: An Artificial Neural Network Approach, Agricultural Water Management, 98, 855–866.

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Kissoon L, Jacob DL, **Otte ML** (2011) Typha angustifolia is exposed to multiple elements under wetland versus dryland conditions. Environmental and Experimental Botany 72:232-241.

Conference Proceedings

Murthy Kasi, Tanush Wadhawan,Halis Simsek, **G. Padmanabhan**, **John McEvoy**, **Eakalak Khan** (2012) Investigating Biodegradation Efficiency of an Enriched Permeable Reactive Biobarrier (ER-PRBB) for Batch Appearance of BTEX Contaminants in Groundwater, ASCE/EWRI World Environmental Water Resources Congress, Albuquerque, NM, May 20-24, 2012.

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.

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.

Shanbhogue, S.S.; Simsek , S.; **Khan, E.; Bezbaruah, A**. Encapsulation of Iron Nanoparticles and Trichloroethylene Degrading Bacteria for Groundwater Clean-up, Proc. World Environmental and Water Resources Congress 2011, pp. 1075-1082, 2011 (also oral presentation).

Lin, Z., A.P. Kirilenko, and **M.M. Rahman** (2011). Coping with uncertainty in assessing climate change impacts on streamflows. Proceedings of the AWRA 2011 Spring Specialty Conference, Baltimore, MD.

Yeo Howe Lim, Xiaodong Zhang, Andrei Kirilenko, William Teng, and **Hasin Munna** (2012) Flood Frequency Analysis of Devils Lake under Current and Projected Future Climates Utilizing HEC Hydrologic Models, NASA Satellite Observations and Downscaled GCM Simulations, 2012 World Environmental and Water Resources Congress, Albuquerque, New Mexico, May 20 – 24, 2012.

John T. Anderson and **Yeo Howe Lim** (2012) Protecting Road Embankments from Overtopping Flow, 2012 World Environmental and Water Resources Congress, Albuquerque, New Mexico, May 20 – 24, 2012.

Derrick Deering and **Yeo Howe Lim** (2012) Efficient Energy Use in Pump Water Supply Systems in Cold Regions, 2012 World Environmental and Water Resources Congress, Albuquerque, New Mexico, May 20 – 24, 2012.

Kyle Hafliger and Yeo Howe Lim (2012) Major Assessments and Adaptation Tools for Flood Management in the Northern Plains under Potential Climate Change Environment, 2012 World Environmental and Water Resources Congress, Albuquerque, New Mexico, May 20 – 24, 2012.

Hasin Shahad Munna (2012) An efficient method for predicting evaporative losses over water bodies in cold regions using a temperature-based model, 2012 World Environmental and Water Resources Congress, Albuquerque, New Mexico, May 20 – 24, 2012.

Capecchi, C.; Bezbaruah, A. Novel Alginate Entrapped Nanoparticles for Groundwater Arsenic Remediation, Proc. World Environmental and Water Resources Congress 2011, pp. 3389-3395, 2011 (also oral presentation).

Krajangpan, S.; Bezbaruah, A.N.; Chisholm, B.J. Groundwater Arsenic Remediation using Amphiphilic Polysiloxane Graft Copolymer Coated Iron Nanoparticles, Proc. World Environmental and Water Resources Congress 2011, pp. 1083-1088, 2011 (also oral presentation).

Shabnam, R.; Simsek , S.; **Khan, E.; McEvoy, J.; Bezbaruah, A**. Diffusion and Treatability Studies with Biopolymer Encapsulated Zero-valent Iron Nanoparticles, Proc. World Environmental and Water Resources Congress 2011, pp. 1543-1551, 2011(also oral presentation).

Kalita, H.; Chisholm, B.; Bezbaruah, A.N. Novel Arsenic Ion-imprinted Polymer: Simultaneous Removal As(III) and As(V) from Water, Proc. World Environmental and Water Resources Congress 2011, pp. 3396-3401, 2011 (also oral presentation).

Simsek, H., Kasi, M., Wadhawan, T., Bye, C., Blonigen, M., and **Khan, E**. (2011) Modeling a Two-Stage Trickling Filter Wastewater Treatment Plant to Simulate the Fate of Dissolved Organic Nitrogen and Its Biodegradability. In Proceeding 84th Annual Water Environment Federation Technical Exposition and Conference, Oct. 15-19, 2011, Los Angeles, CA, Water Environment Federation.

Kasi, M., Simsek, H., Blonigen, M., and **Khan, E.** (2011) Fate of Bioavailable and Biodegradable Dissolved Organic Nitrogen in a Two-Stage Trickling Filter Wastewater Treatment Plant. In Proceeding 84th Annual Water Environment Federation Technical Exposition and Conference, Oct. 15-19, 2011, Los Angeles, CA, Water Environment Federation.

Wadhawan, T., Kasi, M., McEvoy, J., Chu, X., and Khan, E. (2011) Role of Manure Application on Soil in Preventing Groundwater Contamination by Cryptosporidium. In Proceeding 84th Annual Water Environment Federation Technical Exposition and Conference, Oct. 15-19, 2011, Los Angeles, CA, Water Environment Federation.

Conference/Seminar Presentations

Hanson, A. and Sheridan M.A. Environmental Estrogens Inhibit the Expression of Insulin-like Growth Factors 1 and 2 in the Liver and Gill of Rainbow Trout in vitro. Presented at the Annual Meeting of the Society for Integrative and Comparative Biology, Charleston, SC, January 3-7, 2012.

Anusha Balangoda, Veselina Valkov, Jinhai Zhao, and **Wei Lin** (2012) "Seasonal Variations of Water Quality and Algal Growth in the Heinrich-Martin Dam Impoundment" Presented at the North Dakota Water Quality Monitoring Conference, February 27-29, Bismarck, North Dakota.

Meyers, L.M., E.S. DeKeyser, J.E. Norland, C.L.M. Hargiss, and T. DeSutter. 2012. Wetland assessment and ecosystem services. North Dakota Water Quality Monitoring Conference, Bismarck, ND.

DeKeyser, E.S., C.L.M. Hargiss, L.M. Meyers, M.J. Ell. 2012. The development of a multiple collaborator venture connected to the National Wetland Condition Assessment in North Dakota. North Dakota Water Quality Monitoring Conference, Bismarck, ND.

Hanson, A. and Sheridan, M.A. Effects of Environmental Estrogens on Organismal Growth and the Growth Hormone-Insulin-Like -Growth Factor System of Rainbow Trout. Annual Meeting of the Society for Integrative and Comparative Biology, Salt Lake City, UT, January 4-7, 2011.

Anusha Balangoda (2011) Impact of Eutrophication on Water Quality at Heinrich-Martin Dam Impoundment, North Dakota", Young Professionals poster competition at the North Dakota Water & Pollution Control Conference (NDWPCC), 11-13 October 2011, Bismarck

Anusha Balangoda (2011) “Population Variation of Cyanobacteria and Green Algae at Heinrich-Martin Dam Impoundment, ND”, Presented at the 5th International Student Prairie Conference, June 2-3, 2011. North Dakota State University, Fargo, ND.

Veselina Valkov "Temporal-spatial distribution (dynamics) of phytoplankton and diversity in relation to lake physical and chemical condition". Young Professionals poster competition at the North Dakota Water & Pollution Control Conference (NDWPCC), 11-13 October 2011, Bismarck

Veselina Valkov (2011) "Temporal-spatial distribution (dynamics) of phytoplankton and diversity in relation to lake physical and chemical condition". Presented at the 5th International Student Prairie Conference, June 2-3, 2011. North Dakota State University, Fargo, ND.

Kasi, M., Simsek, H., Wadhawan, T., Bye, C., Blonigen, M., and **Khan, E.** (2011) Modeling a Two-Stage Trickling Filter Wastewater Treatment Plant to Simulate the Fate of Dissolved Organic Nitrogen and Its Biodegradability. Presented at the 84th Annual Water Environment Federation Technical Exposition and Conference, Oct. 15-19, 2011, Los Angeles, CA. (Presented by M. Kasi)

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Roy, D.; Kalita, H.; Khan, E.; Bezbaruah, A. Fate of Polymeric Nanoparticle Delivery Vehicles in the Aquifer: Biodegradation of Polydimethylsiloxane, 2011 World Environmental & Water Resources Congress, Environmental & Water Resources Institute, American Society of Civil Engineers, Palm Springs, CA, May 2011.

Wadhawan, T., Kasi, M., McEvoy, J., Chu, X., and Khan, E. (2011) Role of Manure Application on Soil in Preventing Groundwater Contamination by Cryptosporidium. Presented at the 84th Annual Water Environment Federation Technical Exposition and Conference, Oct. 15-19, 2011, Los Angeles, CA. (Presented by T. Wadhawan)

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Krajangpan, S.; Bezbaruah, A.N.; Chisholm, B.J. Polymer Coated Zero-valent Iron Nanoparticles for Arsenic Reduction, The NDWPCC Strom Water Conference, Bismark, ND, October 2011.

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Fisher, J., K. Purcell and **C. Stockwell**. Initial Survey of the Genetic Diversity of Northern Leopard Frog Populations in North Dakota. North Dakota Chapter of the Wildlife Society Annual Meeting, Mandan, ND, 02/2011.

Fisher, J., K. Purcell and **C. Stockwell**. Survey of the Genetic Diversity of Northern Leopard Frog Populations in North Dakota. Joint Meeting of Ichthyologists and Herpetologists, Minneapolis, MN, 07/2011

Gerla, P., M. Dinger, E. McCoy, **K. Overmoe**, & N. Roehrdanz. 2011. Monitoring and Modeling Long-Term Changes of Rainfall-Runoff Response and Water Quality in a Small Agricultural Watershed Restored to Prairie. The Geological Society of America.

Hill, M., S. Fore, **K. Overmoe**, Q. Zhou, R. Lemmons, & C. New. 2011. Dynamics, Metrics, Services and Scenarios for Ecosystems in North Dakota and Northern Minnesota, USA. NASA Carbon Cycle & Ecosystems Joint Science Workshop. (poster).

Overmoe, K. 2011. Comparison of Two Spatial Interpolation Methods for Secchi Disk Transparency in the Devils Lake Basin, ND. Advanced Geographic Information Systems Poster Session, UND. (poster).

Rahman, M.M., and Z. Lin (2011). Hydrologic adaptation of SWAT model to analyze impacts of tile drainage on streamflows in snow dominated upper Red River of the North Basin. ASABE Annual International Meeting 2011, Louisville, KY.

Patent

Bezbaruah, A.; Chishlom, B.; Krajangpan, S. Polymeric Delivery Vehicle for Nanoparticles. Nationalized PCT Patent, 2011/0042,325, Feb 24, 2011.

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Lindsey M. Meyers, Edward S. DeKeyser, and Jack E. Norland. ECOSYSTEM SERVICES AND WETLAND CONDITION ASSESSMENT IN THE PRAIRIE POTHOLE REGION, North Dakota Water Resources Research Institute, Technical Report No: ND12-01, February 2012.

Ishara Rijal and Xinhua Jia. REFERENCE EVAPOTRANSPIRATION AND ACTUAL EVAPOTRANSPIRATION MEASUREMENTS IN NORTH DAKOTA, North Dakota Water Resources Research Institute, Technical Report No: ND12-02, February 2012.

Halis Simsek and Eakalak Khan. FATE OF BIODEGRADABLE DISSOLVED ORGANIC NITROGEN IN FARGO WASTEWATER, North Dakota Water Resources Research Institute, Technical Report No: ND12-03, February 2012.

Kyle Hafliger and Yeo Howe Lim. TECHNIQUES OF ASSESSING CHANGES IN RIVER FLOODING PATTERNS IN THE UPPER MIDWEST, North Dakota Water Resources Research Institute, Technical Report No: ND12-04, February 2012.

Dimuthu Wijeyaratne and Marinus Otte. MULTI_ELEMENT FINGERPRINTING OF RIVER SEDIMENTS TO IDENTIFY DIFFUSE POLLUTION SOURCES, North Dakota Water Resources Research Institute, Technical Report No: ND12-05, February 2012.

Qigang Chang and Wei Lin. Development of Fe-GAC Adsorbent for Arsenic Removal, North Dakota Water Resources Research Institute, Technical Report No: ND12-06, June 2012.

Brianna L.S. Stenger, Mark E. Clark, and John M. McEvoy. Source Tracking of Cryptosporidium in the Red River Valley, North Dakota Water Resources Research Institute, Technical Report No: ND12-07, June 2012.

Sai Sharanya Shanbhogue and Achintya N.Bezbaruah. ALGINATE ENCAPSULATED NANOPARTICLE-MICROORGANISM SYSTEM FOR TRICHLOROETHYLENE REMEDIATION, Technical Report No: ND12-08, June 2012.

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

Recent USGS Reports

- Report to Congress -- Strengthening the Scientific Understanding of Climate Change Impacts on Freshwater Resources of the United States

  In this report USGS details effects of climate change on water availability in 14 local basins nationwide. The USGS National Research Program, in cooperation with USGS Water Science Centers, has released modeling studies that project changes in water availability due to climate change at the local level. So far, the USGS has applied these models to fourteen basins across the U.S., from Oregon to Maine. These local-scale hydrologic models will allow managers to plan for changes in water resources that are specific to their area.

http://water.usgs.gov/coop/products/change/9506_report.pdf

- USGS releases a GeoHealth newsletter highlighting environmental health science, and recent and upcoming publications with an environmental health science emphasis.

http://health.usgs.gov/geohealth/v09_n02.html

- Farag, A.M., and Harper, D.D., eds, 2012, The potential effects of sodium bicarbonate, a major constituent from coalbed natural gas production, on aquatic life: U.S. Geological Survey, Scientific Investigations Report 2012–5008, 101 p.

http://pubs.usgs.gov/sir/2012/5008/

- Summary of Studies Related to Hydraulic Fracturing Conducted by USGS Water Science Centers

http://water.usgs.gov/coop/products/energy/shale.cwp.summary.05292012.v4.pdf

ND State Water Commission Publications

2011-2013 North Dakota State Water Commission Strategic Plan

This new Strategic Plan contains descriptions and overviews of the agency's major projects and programs. Previous plan was published in 2009. The new plan can be viewed at the following link:

http://www.swc.state.nd.us/4dlink9/4dcgi/GetSubCategoryPDF/43/SratPln20112013.pdf

State Engineer Major General David Sprynczynatyk receives Lifetime Achievement Award

Major General David A. Sprynczynatyk is the recipient of the 2011 Lifetime Achievement award fromThe National Water Resources Association (NWRA). This award is in recognition of his membership and active involvement in the NWRA for many years. The NWRA is a nonprofit federation of associations and individuals dedicated to the conservation, enhancement, and efficient management of our Nation's most precious natural resource, water. The NWRA is the oldest and most active national association concerned with water resources policy and development.

General Sprynczynatyk joined NWRA's Board of Directors in 1988. His leadership and vast knowledge of water resources policy earned General Sprynczynatyk the position of President of NWRA from January 1, 1999 through December 31, 2000. Prior to becoming the Adjutant General of North Dakota, General Sprynczynatyk served as North Dakota's State Engineer from 1989 to 2000. Tremendous progress was made in North Dakota's water development under the direction of Sprynczynatyk through his knowledge of water-related issues and efforts to improve and develop the state's water resources.

Major General David Sprynczynatyk assumed the duties of the Adjutant General of North Dakota in 2006.He commands 4,500 North Dakota Air and Army National Guard men and women, along with approximately 1,100 full-time federal and state employees. He is responsible for federal and state missions, and is the Director of Emergency Services, which consists of two Divisions; the Division of Homeland Security, and the Division of State Radio Communications.

Reports on Tile Drainage Study

In 2011, The Red River Retention Authority commissioned the International Water Institute to form a Basin Technical and Scientific Advisory Committee (BTSAC) charged with investigating the hydrologic effects from subsurface drainage (tile drainage) systems in the Red River Basin.

The BTSAC published two reports describing the effects of subsurface drainage and options for managing subsurface drainage systems.

The first report is titled: Impacts of Subsurface Agricultural Drainage on Watershed Peak Flows.

The BTSAC noted that effects of extensive drainage on the flood hydrograph of large watersheds (i.e.the Red River basin) is complex and depends on many factors, including the type of drainage (e.g. surface or subsurface), location of the subsurface drainage within a watershed or basin, topography, soil type, design criteria for the drainage system, and the extent of the drainage infrastructure within a watershed.

The second report is titled: Water Management Options for Subsurface Drainage was released in April 2012. The report investigates the larger hydrologic effects of subsurface drainage, and outlines a strategy for permitting or otherwise managing subsurface drainage systems in the Red River basin to maximize benefits – while minimizing impacts.

Both the reports can be accessed via the link: http://www.rrbdin.org.

NDWRRI partnered with ND Department of Health, USGS, and ND State Water Commission in organizing the ND Water Quality Monitoring Conference February 27-29, 2012 in Bismarck, North Dakota

NDWRRI director, Dr. G. Padmanabhan, served on the planning committee. He also organized and moderated a session titled "Emerging Contaminants and Threats to Water Quality". Seven past and current NDWRRI Fellows and eight institute faculty presented at the conference.

Details of the conference can be viewed at: http://info.bismarckstate.edu/ceti/waterquality/

Presentation abstracts can be viewed at http://info.bismarckstate.edu/ceti/waterquality/pdfs/presentation-abstracts.pdf

Dr Christina Hargiss presents her paper entitled "wetland Assessment in North Dakota using Three Tiered Assessment Methods."

Greg Wiche , USGS, provides opening remarks at the conference.

Conference participants attending the poster presentations at the networking social.

2nd NDWRRI Annual Distinguished Water Seminar

The 2nd Annual Distinguished Water Seminar was held on February 21, 2012 at NDSU campus open to faculty and students of NDSU and UND and the public. Dr. Kurt Fausch, a nationally and internationally known conservation biologist, conducted the seminar titled, " Linked for Life: the importance of sustaining hidden connections for conservation in streams." The talk was co-sponsored by the the Environmental and Conservation Sciences program, Agricultural and Biosystems Engineering department, Civil Engineering department, Soil Science department, and School of Natural Resources Sciences and Management, all of North Dakota State University. The seminar is the second of the annual Distinguished Water Seminar series by eminent water professionals on emerging issues, challenges and new research directions in water resources.

Dr. Fausch is a professor in the Department of Fish, Wildlife, and Conservation Biology at Colorado State University. He teaches Fish Conservation Biology and a graduate course in Community Ecology, and is active in the Graduate Degree Program in Ecology. His collaborative research has taken him worldwide, and especially to Hokkaido in northern Japan where he worked with colleagues over a 15-year period. These experiences were chronicled in the documentary film RiverWebs, directed and produced by Jeremy Monroe of Freshwaters Illustrated, which has been broadcast to more than100 million homes nationwide on PBS. He has received several prestigious awards for his research and outreach, including the first International Fisheries Science Prize from the World Council of Fisheries Societies (2008) and Awards of Excellence from the American Fisheries Society (2010). He serves on the Independent Science Advisory Board of the Northwest Power and Conservation Council, which advises managers of the Columbia River about fish and wildlife conservation. Kurt is currently writing a book for a popular audience with the goal of engaging the public in understanding the interconnections between streams and rivers and their landscapes, and the importance of conserving these ecosystems.

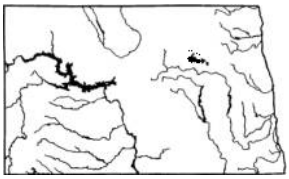
Following the seminar, students and faculty had opportunity to interact with Dr. Fausch.

G. Padmanabhan, Director NDWRRI, Craig Stockwell, Director Environmental and Conservation Sciences Graduate Program, and Xuefeng Chu, Civil Engineering department were the organizing committee members.

Dr. Kurt Fausch and Mr. Bill Schuh of ND State Water Commission, a member of ND WRRI advisory committee, engaged in after-talk discussion

From left to right, Dr. Kurt Fausch, Dr. Robert Hearne (Agricultural Economics, NDSU), Mr. Bill Schuh (ND State Water Commission), and G. Padmanabhan (NDWRRI Director) in after-talk discussion

Dr. Kurt Fausch in discussion with Mr. Mark Wiltermuth, U.S.G.S.—Northern Prairie Wildlife Research Center, Jamestown, ND



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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.